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A Campaign of Enlightenment.

WITH the month of September there opens an electrical campaign which, at least in this country, is of altogether unprecedented magnitude and significance; it behoves every person connected with the electrical industries, in whatever capacity, to throw his weight into the battle and to use every legitimate means to carry it through to a victorious conclusion. The opportunity is unique and beyond price: during recent years, and especially during the past 18 months, the Government of the day, and the leaders of all political parties, have impressed upon the public the importance and urgency of the immediate development of electricity supply throughout the whole country, and have thus carried on a most effective propaganda, by which the public mind has been taught to look upon electricity and all that it stands for as the hope of our industrial salvation. That their view is based upon a foundation of truth is our sincere conviction; how best to attain the ideal is a matter regarding which not all parties are agreed—but all are unanimous with regard to the necessity of making the utmost use of electricity for all purposes, which was demonstrated beyond the reach of doubt by the Report of the Electric Power Supply Committee under the chairmanship of Sir Archibald Williamson in 1918, and has repeatedly been confirmed by later investigations, culminating in the Report of the Weir Committee of May last year.

So far the Government has directed its attention mainly to the development of electricity supply; by the appointment of the Electricity Commissioners in 1919-20 it made a great step forward, and the splendid work that they have accomplished, under conditions of extreme and unforeseen difficulty, commands the respect and gratitude not only of the electrical industries but of the whole nation. The present Government is carrying through a further measure which must exercise a profound influence upon the future of electricity in this country, but this is explicitly directed towards the

development of the generation and transmission of electricity throughout Great Britain, on a gigantic scale, and as the Prime Minister indicated when he unfolded the Government scheme, it leaves untouched the extremely important question of distribution. That is a matter which is to be dealt with mainly by the existing distributing authorities, and the education of the people to the right use of electricity is left to them and to the vast body of manufacturers, contractors, and others who come into more or less intimate relations with the consumers, actual and prospective, of electricity.

It is to this aspect of the subject that we desire to draw the attention of our readers. It is imperatively necessary for the electrical industries to "get busy" immediately and to take the tide of fortune as it flows. Most fortunately we have in being a most efficient and admirably organised publicity department in the shape of the British Electrical Development Association, under the guidance of a past master in the art of generalship—Mr. J. W. Beauchamp—which has served its apprenticeship, acquired experience, and secured the confidence of the whole industry; and its younger brother, the E.L.M.A. Lighting Servie Bureau, under the talented leadership of Mr. W. E. Bush, working mainly on educational lines, has done splendid work in raising the standard and elevating the ideals of electrical illumination. These two bodies have for months past had in preparation a "Better Home Lighting Campaign," which is now set in motion; we give some preliminary particulars of it elsewhere in this issue. It will be conducted at very great expense, and on strategical lines which command our admiration. We shall deal with the plan more fully on later occasions; at the moment our object is to urge, with all the emphasis at our command, electricity supply authorities, manufacturers, wholesalers, contractors, and electrical shopkeepers of every description, to back up the campaign with their utmost energy. The fruits of the harvest will fall to them; let them do their part in sowing the seed—and let them do it *now*. The scheme is such that if it is carried out according to plan, success is certain. An enormous number of possible clients will be brought into their shops and showrooms—it is for them to take advantage of the unique opportunity afforded by personal contact with an inquiring public. The campaign is designed to awaken interest, first of all, in electric lighting; that is the key which opens the door to electricity—once the service is laid, the rest will follow. There are over 5,000,000 British homes which have not yet enjoyed the advantages of electrical service—a magnificent field for cultivation! And now is the time when all should pull together for the common good.

The Shannon Power Scheme.

THE Irish Free State Government will shortly have to take in hand the constitution of the authority which will control the Shannon Power Scheme when it is completed. This will be a very important body, for not only will it have charge of the electrification works, and their later extension should such become necessary, but it will also have to arrange for the construction of the distribution lines, the sale of energy, and the general maintenance of the entire scheme. It will be necessary to pass another Act in the Oireachtas for the purpose of setting up this authority, and defining the powers and the duties of its members. Some months ago the hope was officially held out that electricity would be generated under the scheme early in 1928, but it is evident that the new Board, or Commission, will need to be in existence long before then, so that everything may be in readiness when the supply of electricity is available for general use. A great deal of preliminary work will be necessary, especially in the way of educating the public as to the advantages of electricity, and of creating organisations for co-operative purchasing, and matters of that kind. The Minister for Industry and Commerce is understood to have been devoting a good deal of attention to the scheme of organisation of this new authority, and it is expected that he will be in a position to make an announcement in respect of it before the end of the present year. In view of the other important measures for which time has already been allocated, it seems hardly possible that he can get the Bill through Dail Eireann during the coming autumn session, but it can scarcely be delayed beyond the early part of next year, if the new authority is to be given a reasonable chance of having its plans in order before the electricity works are completed. The new body will probably consist of four members or directors—a chairman, who will be a man of general administrative capacity; an engineer, who will be responsible for the technical side of the project; a third director, who will look after the sale of energy; and a fourth, who will be in general control of finance. Such, at any rate, was the plan of organisation originally proposed, though to what extent it may be altered as a result of the further consideration now being given to the subject, it is impossible to say. The foreign experts who reported to the Government on the possibilities of the scheme suggested that the proposed authority should be set up as soon as a decision to proceed with the scheme was taken, so that from the very beginning one and the same organisation should have charge both of the constructional work and of the permanent administration of the undertaking. This plan was not adopted, at least in the form suggested, the Ministry for Industry and Commerce having kept the control of the constructional works in its own hands. But it is possible that the idea underlying the experts' suggestion may ultimately be realised, for it is not unlikely that the directors to be appointed will be recruited mainly from those who have been representing the Minister in the organisation and development of the scheme. If report speaks correctly, a prominent official of the Ministry is designated chairman of the Board to be set up, and the engineering director will also be selected from amongst those already engaged on the scheme.

The Electrical Equipment of Automobiles.

IT is fairly well known that among the benefits offered to members and associates of the Royal Automobile Club is a free relief car under its "Get-you-Home" Service in the case of breakdowns and accidents on the road. In every case in which assistance is given a voucher has to be completed giving the cause of the breakdown. From these returns much useful information is to be obtained, and for this reason the R.A.C. undertakes the classification of the details and issues them in the form of an annual analysis.

The figures for the year 1925 have just been issued and, as in past years, the causes of breakdown are classified under eight different main headings, the most important of these being subdivided. The figures are based on thousands of cases dealt with throughout the year, and the percentages are, therefore, quite reliable.

The R.A.C. has records covering the whole of the breakdowns since the inception of its "Get-you-Home" Service after the war, and these show that the variation in the causes of breakdown and accident is almost negligible. An analysis of the figures brings to light the fact that ignition troubles have not only invariably headed the list, but show a slight upward tendency, having advanced from 18.4 per cent. in 1923 and 20.7 per cent. in 1924 to 22.7 per cent. in 1925. This is a little disturbing, as one would have expected that even in users' hands ignition reliability would rather improve from year to year.

Although it will generally be held in electrical circles that any trouble experienced with modern ignition equipment is due more to the user himself than to the apparatus provided, it is obvious that in the design and manufacture of equipment, makers, for the sake of their own reputation, must take this factor into consideration and permit no slackening to occur in their efforts to produce apparatus and components that shall be more trouble-free.

Curiously enough, and perhaps contrary to expectation, the electric lighting and engine-starting equipment of cars is giving rise to considerably less roadside trouble than ignition, lighting failures being set down as the cause of only 2.3 per cent. of the breakdowns, and the starting equipment of only 0.5 per cent.

Modern Cement Manufacture.

The Application of Electric Motors at Bevan's Works, Northfleet.

THE Associated Portland Cement Manufacturers, Ltd., and the British Portland Cement Manufacturers, Ltd., claim to produce about two-thirds of this country's cement output, something like three million tons a year, and they have a progressive policy which should assure the maintenance or betterment of the proud position of being the country's largest makers of cement. Like so many other important industrial groups, they have found that while quality helps to sell their products, prices must be reduced to the minimum to increase consumption. Low costs depend nowadays partly upon the employment of the right kind of power, and the A.P.C.M. and B.P.C.M. have found that electricity is the most efficient agent for their purpose. They are proceeding, therefore, with the electrification of a number of their factories, and the latest example is Bevan's Works at Northfleet, Kent. This works has been entirely reconstructed, and it is now the largest and most up-to-date of its kind in Europe. It is designed to turn out 10,000 tons of "Blue Circle" and "Ferrocrete" rapid-hardening cement per week, and, incidentally, it is of interest to mention that the latter type of cement was mainly used in the construction of the buildings. "Ferrocrete" hardens so rapidly that it is possible to remove the shuttering and proceed with the next stage after allowing it to set for 24 hours, whereas with ordinary cement it is a matter of days before the shuttering can be safely taken away.

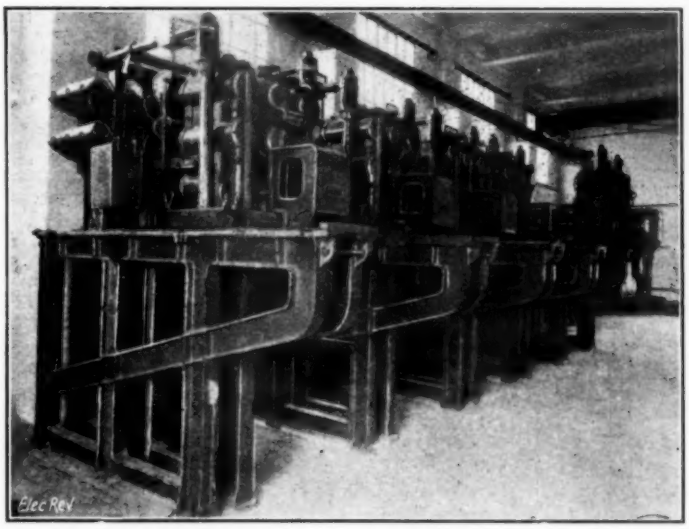


Fig 1.—Metropolitan-Vickers "K" type Switchgear.

Fig. 2.—The Receiving Sub-station.

The magnitude of the electrical side of the plant can be gauged from the fact that the ultimate maximum load will be 6,500 kW; at present only two of the kilns are in operation, another being nearly ready.

The power is supplied by the County of London Electric Supply Co., Ltd., from its Barking station, through the Kent Electric Power Co., Ltd.

The electrical plant as a whole has one or two notable characteristics; with only five exceptions (the tube mills) the motors are of the squirrel-cage type driving, where the starting conditions are heavy, through Broadbent centrifugal clutches. All motors, including those for the tube mills, are mounted on roller or ball bearings of Messrs. Hoffman's manufacture. The cable system is totally enclosed right up to the points of application, and the smaller wiring (lighting, &c.) is in conduit, with iron-clad switches and fuses, reducing risks of failure and shock to a minimum. The cable work was carried out by Messrs. W. T. Henley's Telegraph Works Co., Ltd., and the lighting work by Messrs. Tredegars, Ltd.

The power for the works is transmitted from Barking at 33,000 V, by means of underground cables, and is delivered at the supply company's sub-station at the washmills, which are situated at about half-a-mile from the main factory. The supply is controlled by six Metropolitan-Vickers "K" type switches (fig. 1), with a breaking capacity of ¾ million kVA each, and passes on to two banks of three single-phase transformers of 2,500 kVA capacity each, *i.e.*, two 7,500-kVA groups, which step the pressure down to 3,000 V. These transformers, as will be seen from fig. 2,

Fig. 3.—The Washmills Sub-station.

are situated between the supply company's sub-station and the works receiving sub-station. In the latter are situated the power company's 3,000-V control switches, also of Metropolitan-Vickers " K " class, and

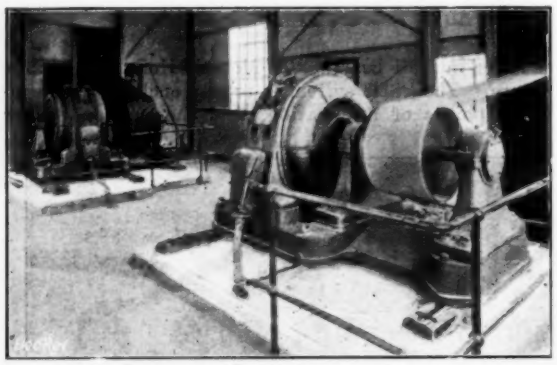


Fig. 4.—Roughing and Finishing Mill Motors.

on which is accommodated the metering equipment. The bus-bars from these two switches are continued and connected to ten sets of Metropolitan-Vickers truck-type gear, the switches in which have each a rupturing capacity of 100,000 kVA. This switchboard controls two feeders to the washmill sub-station, six feeders to the main works sub-station, one clay mill feeder, and one metering panel. The main equipment in the washmill sub-station (fig. 3) is two 750-kVA transformers, which reduce the incoming pressure (3,000 V) to 500 V. The switchboard, which is again Metropolitan-Vickers truck-type gear, consists of two feeder panels, a metering panel, a transformer panel, and two motor panels. The l.p. distribution gear was supplied by Messrs. George Ellison. Above the washmill sub-station is situated one of two motor houses, which is illustrated in fig. 4. In each of these are installed a 200-h.p. motor for driving the roughing mill, and a similar machine coupled to the finishing mill gear. The former machine is fitted with barring gear driven through worm reduction gear by a high-torque motor. These motors are controlled by A.E.C. auto-transformer starters, which are totally enclosed and designed for operation by unskilled labour. At this point it is desirable to say something of the processes carried out. As we have already said, the washmill plant is about half-a-mile from the works; it is in a convenient situation as regards the chalk deposits. Chalk is quarried by a 20-ton, 3-cu. yd. Ruston and Hornsby electrically-driven navvy, which has an average load of 230 kW, and is delivered to the mill by

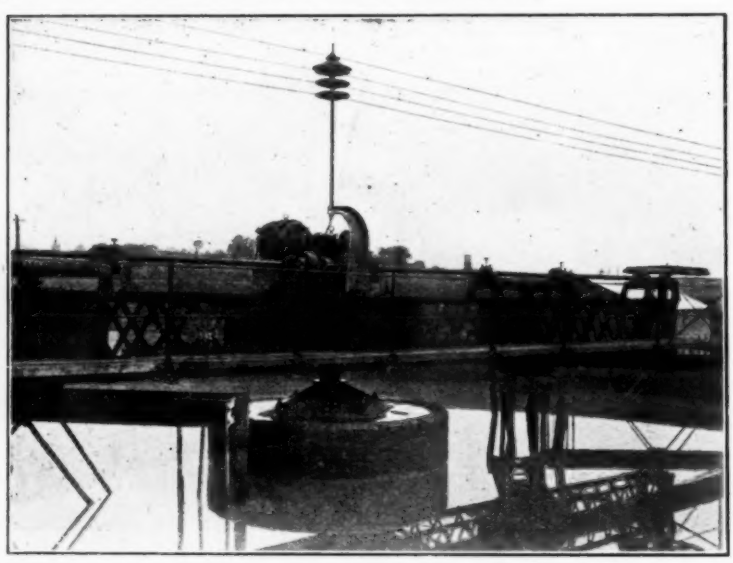


Fig 6.—A 66 ft. Diameter Mixer.

standard-gauge 12-ton trucks. Each truck is run on to a Babcock & Wilcox " Tippler " hoist, driven by a 50-h.p. " Maxtorq " motor (Lancashire Dynamo and Motor Co.), which raises it about 40 ft. and empties its contents into a hopper feeding the two roughing mills. The operation of the hoist is fully automatic, and the limit switches are all reinforced by emergency cut-outs. The hoist is push-button controlled from the ground level. As the truck moves upwards, the clay feed is put into operation, and it provides the correct proportion of clay for the mixers. The clay is supplied in the form of slurry from a site about three-quarters of a mile from the main washing plant. The three clay washmills are each equipped with a 100-h.p. motor driving through worm-reduction gear. A motor of similar size is used for pumping the slurry to two 66-ft. diameter mixers situated near the washmill. The power is transmitted to this plant at 3,000 V by an overhead line. The water for the washmills is taken from an old pit by two pumps, which take their supply from the overhead line through local transformers, which reduce the pressure to 500 V. These pumps are controlled from the main washmill. The finished slurry passes from the washmills to a sump and is delivered from there by means of six three-throw pumps driven by 50-h.p. squirrel-cage Crompton motors

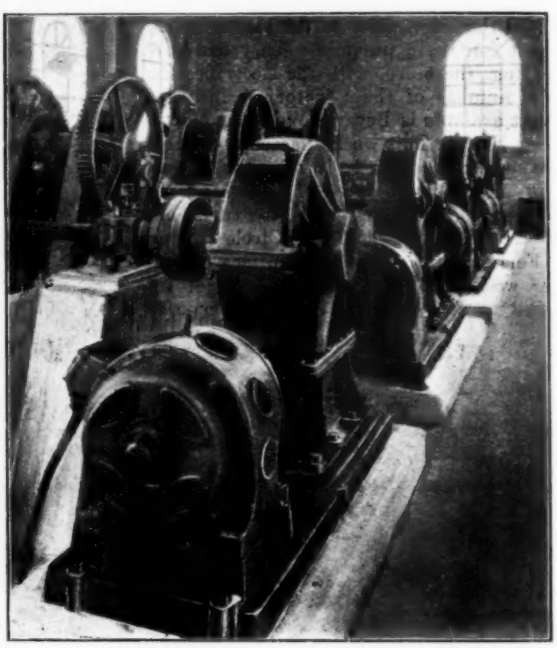


Fig. 5.—Slurry Pumps.

(fig. 5) to six 66-ft. mixers at the main works. All the mixers are driven by 12-h.p. Crompton motors arranged for direct switching. The mixers, one of which is depicted in fig. 6, are of the well-known " sun and planet " type, and the power is transmitted to the motors situated on them by means of overhead conductors and collector rings supported on a post in the centre of the mixer.

This brings us to the main works. Power is delivered from the washmill sub-station to the main works sub-station by underground cables drawn into earthenware ducts, and inspection manholes are provided at fairly frequent intervals. In the main works sub-station are five 750-kVA M.-V., 3-phase, star/star-connected transformers with insulated neutral, which reduce the pressure from 3,000 to 500 V. The high-pressure switchgear (fig. 7) comprises 15 panels of the Metropolitan-Vickers cubicle type. There are six feeder panels, one for metering, one for the air compressors and cement pumps, two for the grinding mills, and five for the transformers. An Evershed recorder on the metering panel shows the total works' load; power is

purchased on a kW (not a kVA) maximum demand basis. The low-pressure equipment in this sub-station (fig. 8) comprises 17 sets of Ellison draw-out units with common bus-bars. Each feeder panel is provided with its own metering arrangements.

The coal used in the cement-making processes is brought by steamers to the works jetty (which can accommodate 8,000-ton vessels at the lowest tide) and is discharged by means of grabs on the jetty cranes, which are dealt with later. It is dropped into hoppers, which have a regulated feed on to a small belt conveyer, and thence it goes on to a long rubber belt conveyer, which carries it to the coal store. From the store it is taken as required by a belt conveyer to the dryers, each of which is driven by a 30-h.p. Crompton motor, and back again by another band conveyer to the grinding mills. The Brookhirst panel group for the control of the coal-handling equipment is conveniently mounted on the firing platform.

The coal-grinding plant consists of six Fuller-Lehigh coal mills, each driven by a 75-h.p. M.-V. vertical-spindle squirrel-cage motor, through a Broadbent clutch pulley and belt. Each motor is controlled by a Brookhirst panel mounted near the machines. The coal from the mills is transmitted either to a store or straight to the kiln burners. The latter are equipped with feed screws operated by B.T.-H. variable-speed motors.

The kilns (fig. 9) are the largest in Europe, being 250 ft. in length and 11 ft. 6 in. in diameter; they came from the Barrow works of Messrs. Vickers, Ltd. Their length necessitates five substantial bearings upon which circumferential bands roll. The drive is in the centre, and is provided by a Lancashire Dynamo and Motor Co.'s two-speed (50- and 80-h.p.) squirrel-cage motor. The power is transmitted through a Broadbent clutch and a David Brown reduction gear to a massive double spur reduction gear, the final drive being a pinion and a large gear wheel embracing the centre of the kiln. The slurry is fed into the kilns by three chain-bucket elevators driven by 5-b.h.p. B.T.-H. variable-speed commutator motors. The kiln-controlling gear, including Cambridge pyrometer equipment, is mounted on the firing platform.

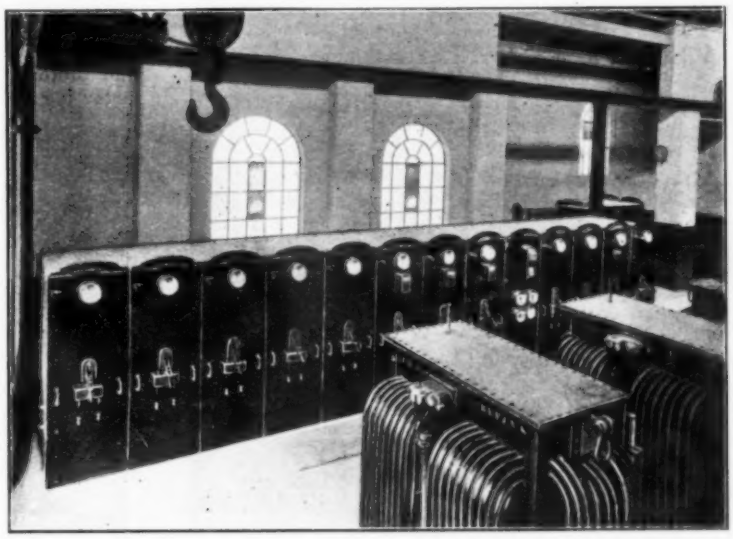


Fig. 7.—Main Works Sub-station, h.p. Switchgear.

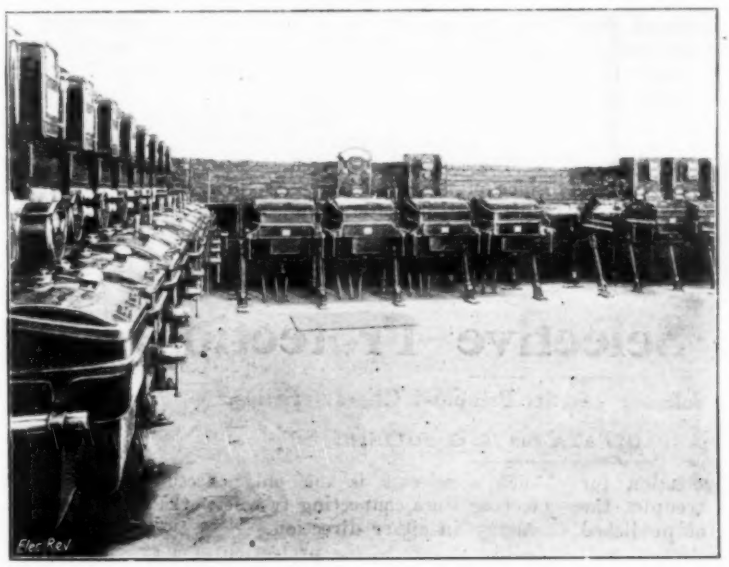


Fig. 8.—Main Works Sub-station, l.p. Switchgear.

As the cement clinker is formed inside the kilns, it falls into coolers mounted below, and the sensible heat is drawn from these and used in the coal dryers. The clinker is then discharged from the coolers on to a duplicate belt conveyer, which delivers into a bucket elevator and conveyor discharging into storage hoppers, which may overflow into an extensive storage yard. From these hoppers the clinker gravitates to the tables feeding the tube mills. At present there are five of these mills, each driven by a 550-h.p. English Electric slip-ring motor through David Brown double-helical gears which reduce the speed from 589 to 113 r.p.m., and are connected to the pinion shaft of the mill (fig. 10). Two further mills are shortly to be added, and these will be driven by 750-h.p. Crompton synchronous induction motors running at a speed of 158 r.p.m., at which speed the mill-shaft will be driven. When the new mills are installed this section of the works will be taking well over half of the power supplied. The mill motors are provided with M.-V. liquid rotor starters and M.-V. control gear, consisting of two feeder

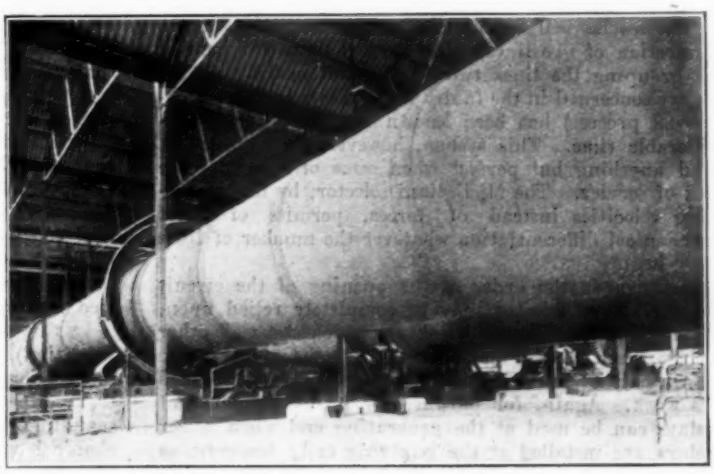


Fig. 9.—The Kilns, showing Method of Driving.

panels and one panel for each machine. The tube mill building is ventilated with air supplied by Sturtevant fans and washers. Upon discharge from the tube mills, the finished cement is taken by two Fuller-Kenyon screw pumps, each coupled to a 125-h.p. Crompton

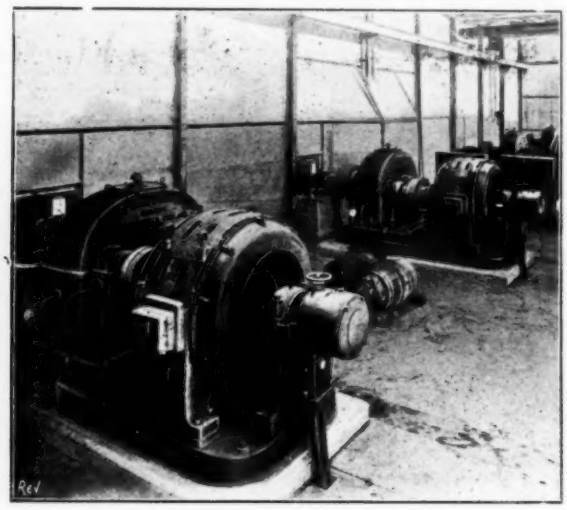


Fig. 10.—The Tube mill Motors.

motor. The screw, of decreasing pitch, forces the cement to the end of the pump, whence it is taken up by compressed air at 100 lb. per sq. in. through a 6-in. pipe line to eight silos holding 2,000 tons of cement each. The necessary compressed air is supplied by a battery of three Alley & McLellan sets, one driven by a 160-b.h.p. M.-V. and two by 100-b.h.p. Crompton squirrel-cage motors, controlled by A.E.C. auto-transformer starters (fig. 11). The cement is drawn from the silos on to belts which run beneath them as required, and is sent to the packing department on its way out of the works.

The handling arrangements on the jetty are very complete, the principal feature being two Babcock and Wilcox level-luffing cranes (there will eventually be four). The motors providing power for the several movements of the crane are of the Lancashire Dynamo and Motor Co.'s "Maxtorq" type. The hoisting motor is rated at 50 h.p., the slewing motor at 15 h.p.,

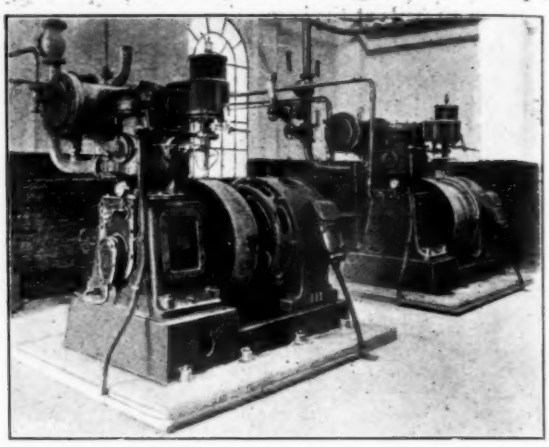


Fig. 11.—Air Compressors for Cement Pumping.

the luffing motor at 5 h.p., and the travelling or propelling motor at 20 h.p. Allen West control gear is installed, consisting of a contactor panel and drum-type controllers of the "straight on" and "straight off" type. The double grab-rope drum is fitted with an M.V. solenoid brake.

The above description does not convey an adequate idea of the cement-manufacturing plant, but it shows how efficiently electricity is serving an important British industry.

Over-load Selective Protection.

The Modigliani Selector and its Principal Characteristics.

By A. BARBAGELATA and M. G. SOLDINI.

THE problem of providing adequate protection for electricity supply systems is one which occupies the minds of all engineers, and the number of published works that treat of over-load selective protection well illustrates the importance this matter has assumed. Therefore, an account of the selector invented by Mr. Urberto Modigliani should be of general interest.

The mechanical differentiati n of two relays for the protection of two lines, or of several lines (the method of grouping the lines two by two and making all the relays concerned in the faulty line operate in the switching-off process) has been known and used for a considerable time. This system, however, is complicated, and anything but perfect when some of the lines are out of service. The Modigliani selector, by differentiating velocities instead of forces, permits of direct mechanical differentiation whatever the number of lines may be.

As regards the order of the opening of the circuit breakers, this selector may be completely relied upon, on account of mechanical locking, which stops all other relays when one is acting, allowing them to operate again only when the one relay in question has completed its work. Again, for parallel-line protection, current relays can be used at the generating end when power relays are installed at the receiving end; however, as regards protection, reversibility of the lines is impossible, for if the direction of the energy changes, it is necessary to change the relay connections at both ends.

With the Modigliani selector, when power relays are used at both ends of the lines, protection is automatically provided whatever the direction of the energy may be; such a selector is the only effectual means of protecting lines connecting two networks which may carry energy in either direction.

In the case of the protection of a system of parallel lines, the elementary relay employed by Mr. Modigliani is similar to an induction meter with a vertical shaft; the current circuit is connected with the line (through a current transformer), and the voltage circuit is excited with the corresponding phase pressure, so that the device revolves with a speed proportional to the phase power. Fig. 1 represents a system of four three-phase lines schematically, omitting for simplicity all transformer and voltage connections. The n relays connected to the corresponding conductors of n lines are put in a row and mechanically coupled to one horizontal shaft by means of worm gear. The connection consists of electro-magnetic couplings, not shown in fig. 1, actuated by the currents flowing through the relays, so that all and only the relays of the line in service are automatically coupled with the horizontal shaft.

In this way, if the lines are equally loaded (normal condition), the relays will revolve with the same speed and no force will be exerted on the gears. On the contrary, if a phase of a line becomes faulty, the corresponding relay will tend to accelerate, and if the mechanical couplings were obtained with ordinary spur gearing, the whole system would accelerate, reaching a velocity proportional to the average value of the power of the different lines. As the worm gear is not reversible, the horizontal shaft cannot drive the vertical shafts, so that it continues revolving at an angular velocity corresponding to that of the slowest relay.

Thus, when one of the relays tends to accelerate, an effort is generated between its worm gear and the corresponding elipsoidal wheel, and this effort tends to raise the vertical shaft. Since this shaft, as shown in figs. 2 and 3, is divided into two parts by a special coupling which allows the higher part bearing the worm gear to rise, the higher part of the shaft of the relay, which tends to accelerate more than the others, will rise. It is this

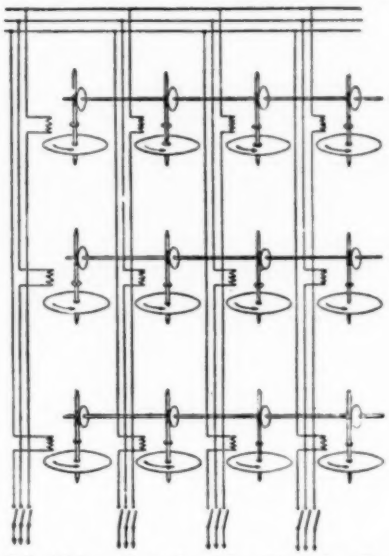


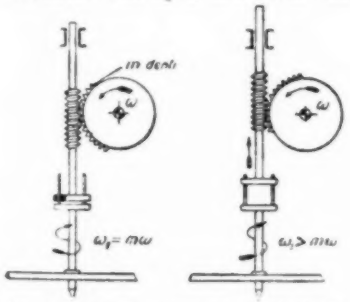
Fig. 1.—Modigliani Selector Protection of Four Three-phase Parallel Lines.

rising which actuates the system in the following way: The shaft, by rising, closes an auxiliary circuit which controls:

(i) A locking magnet actuating a lever that prevents the rising of the shafts of all the other relays, which eventually tend to accelerate.

(ii) A closing magnet, which closes the contacts of the trip circuit of the line whose relay has operated; but the breaker does not open, for the trip circuit is kept open by a general switch.

(iii) A time relay, which after a time (may be from ½ to 10 seconds) closes the general tripping switch, and then the breaker of the faulty line opens; the corresponding relays are disconnected from the horizontal shaft, and the whole system of the other relays regains normal operating conditions. So, if several lines become faulty, but to different extents, their corresponding breakers will open one after the other in due time



igs. 2 and 3. – Elementary Relay of the Modigliani Selector.

e.g., with intervals of two seconds) in an inverse order to the importance of the fault.

To appreciate fully the reversibility of the system, suppose (referring to fig. 1) that the direction of the energy changes, namely, that it flows from the lines to the bus-bars. All relays will invert their revolving direction and, if a line is faulty, its flowing energy will decrease and may also reverse; therefore, its relay will tend to reduce its velocity, but a slackening of speed in the new revolving direction is equal to an increase of the velocity in the previous direction, so that once again the worm gear of the affected relay will raise the higher part of the shaft, and so bring about the operation of the system.

Neglecting construction details, which make the selector, notwithstanding its apparent complexity, a strong and reliable device, some of its characteristics may be outlined. In order that the higher part of the shaft may rise so as to close the auxiliary circuit, the corresponding relay must gain from ½ to ⅓ of a revolution on the other relays coupled to it. The operation time depends on the excess of torque, that is, on the difference between the powers operating on the different relays. In the ordinary types of 5 amp. and 150 volts (750 watts), a difference of about 100 watts (1/7 to 1/8 of the load) is necesary to produce operation in about 6 or 8 seconds. The difference increasing, the necessary time diminishes, even to less than a second, when the difference is equal to normal load. It is, in fact, an inverse time system of protection proportional to the gravity of the fault. The above-mentioned fractions of time concern relays at the outgoing points, which revolve therefore in the normal direction. When the flow of energy reverses, as in the case of relays at the receiving end of a line, the fractions of time are reduced according to the number of parallel lines. In the first case the necessary energy to raise the higher part of the shaft is supplied by the accelerating relay, while in the second case it is supplied by all relays together, which maintain their velocity; that of the faulty line slackens speed or stops.

The greater sensitivity at the receiving end than at the generating end of the line is very convenient, as the receiving relays are the ones which feel the voltage drop in a greater degree. The selector is indeed subjected to the general conditions, which limit the sensitivity of all protection systems and especially of power relays. The Modigliani device operates satisfactorily even when the voltage drops 10 to 12 per cent. under the normal value. As regards power factor, recourse can be had to a suitable phase-error, and the device can be excited across the most convenient phase. Concerning the setting of each relay and of its differential effect, it is easy to adjust the brake magnets of the different disks and load a lever, which is raised, while moving, by the higher part of the shaft.

Although the Modigliani selector was first developed for the protection of parallel lines, it can be applied in many different cases: If three elementary relays mechanically coupled together be connected to the three phases of a three-phase circuit, they will provide a reliable balance relay. A tendency to utilise the unbalance which generally takes place in the three phases when a fault occurs has been lately manifested; the Modigliani selector, whose elementary relays may in this case be controlled only by the current, applies to such a case: three elementary relays connected to the three

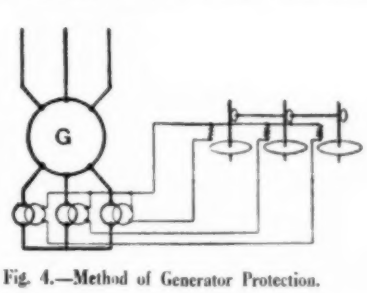


Fig. 4.—Method of Generator Protection.

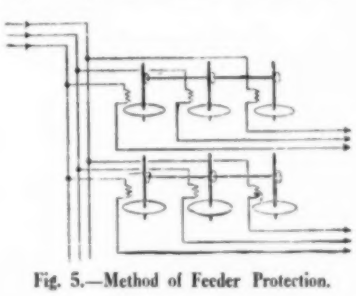


Fig. 5.—Method of Feeder Protection.

neutral conductors of a three-phase generator, and mechanically coupled, afford reliable protection against both internal and external troubles (fig. 3).

In the case of a central station, or a sub-station, which feeds several radial and independent lines (fig. 4), it is possible to obtain the best selective protection by means of the previously-mentioned locking system, causing the breaker of the more damaged and unbalanced line to open first. The blocking system makes surer the selective action of the balance relays. When several lines are fed from the bus-bars of a sub-station, a fault generally produces an increase of the current of the motors fed by the other lines, so that ordinary overload relays operate on all lines. It is not so with balance relays, for on normal lines the increase of load is generally balanced, whilst an unbalance takes place only on the faulty lines.

Electricity Supply in Great Britain.—XVII.

Shropshire, Staffordshire, and Warwickshire.

The accompanying maps of Shropshire, Staffordshire, and Warwickshire are reproduced by permission of the Controller of H.M. Stationery Office.

Statutory powers for general supplies of electricity are held or have been applied for in respect of the hatched areas on each of the maps.

It is not proposed to reproduce the maps of Worcestershire and Herefordshire, as both these Counties are covered by statutory powers for general supplies of electricity.

In addition to the above-mentioned statutory powers, it should be noted that various other powers are held under Electricity Acts and Electricity District Orders.

The following is a list of the existing authorised undertakers (and certain other bodies) whose areas are wholly or partly included in the above Counties:—

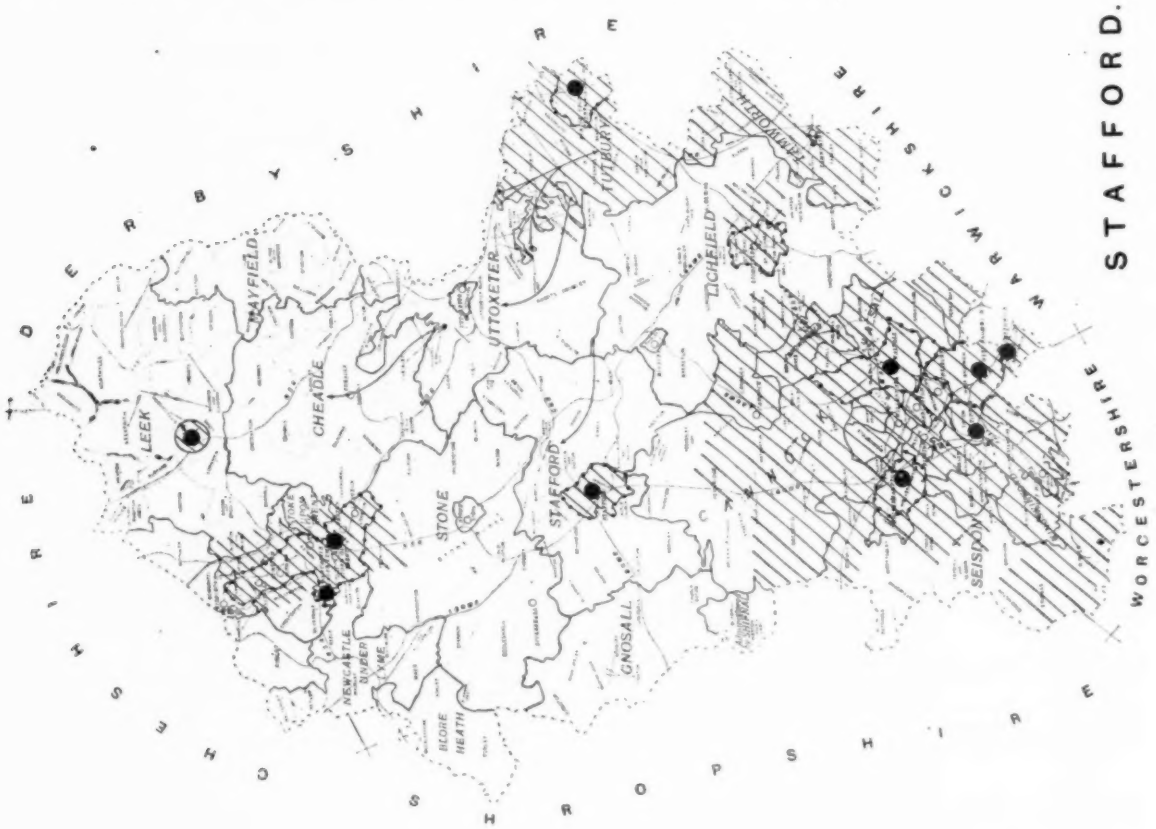
The South-West Midlands Advisory Joint Committee.
The East Midlands Electricity Advisory Board.
The North Wales and South Cheshire Joint Electricity Authority.
The West Midlands Joint Electricity Authority.

Local Authorities.

Birmingham Corporation.
Burton-on-Trent Corporation.
Cannock Urban District Council.
Coventry Corporation.
Hereford Corporation.
Leek Urban District Council.
Lichfield Corporation.
Lye and Wollescote Urban District Council.
Malvern Urban District Council.
Newcastle-under-Lyme Corporation.
Nuneaton Corporation.
Rugby Urban District Council.
Shrewsbury Corporation.
Stafford Corporation.
Stoke-on-Trent Corporation.
Sutton Coldfield Corporation.
Tamworth Corporation.
Walsall Corporation.
West Bromwich Corporation.
Wolverhampton Corporation.
Worcester Corporation.

Companies.

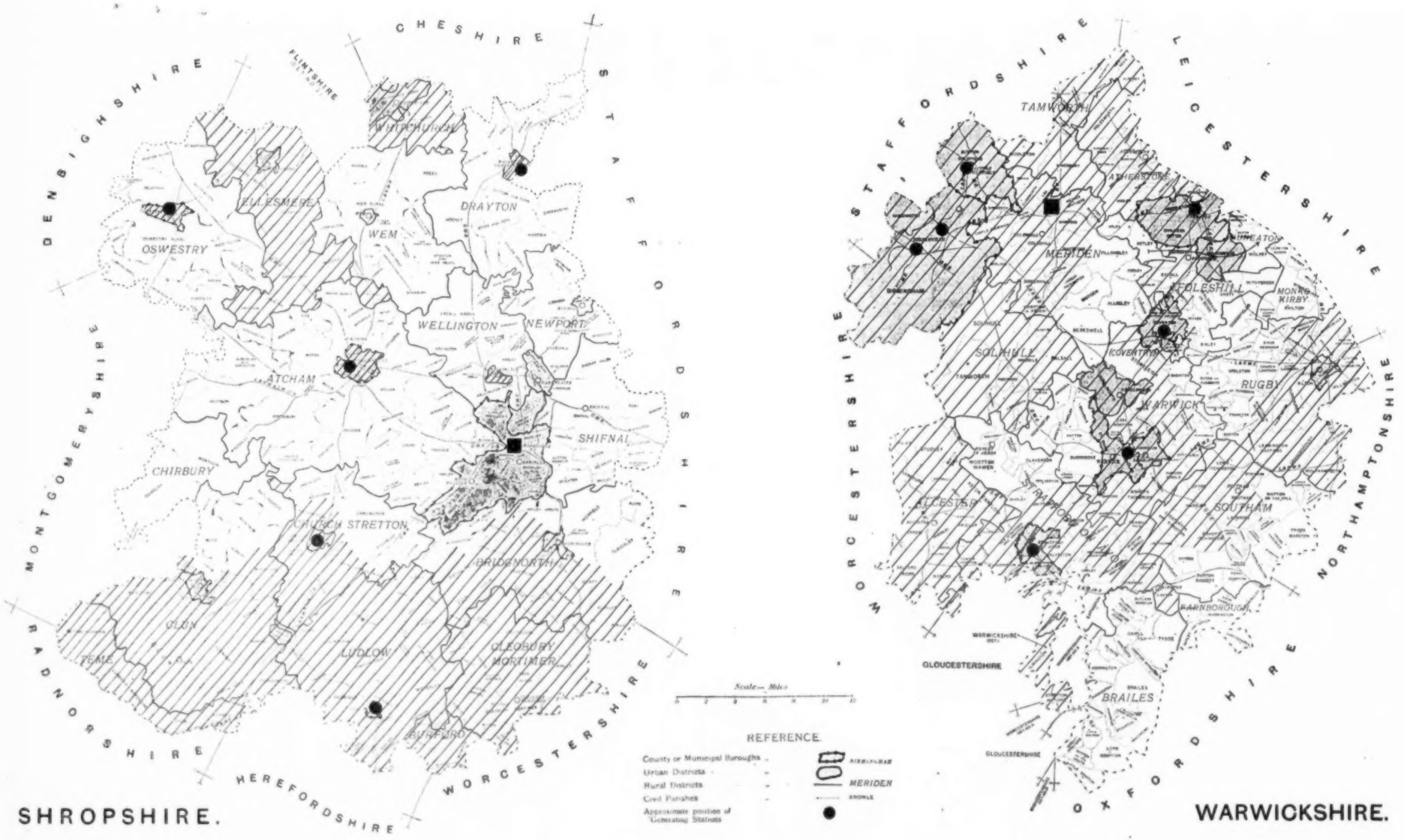
Cannock Chase Colliery Co., Ltd.
Church Stretton Electric Supply Co., Ltd.
Halesowen Lighting & Traction Co., Ltd.
Kidderminster & District Electric Lighting and Traction Co., Ltd.



Leamington and Warwick Electrical Co., Ltd.
Ledbury Electric Supply Co., Ltd.
Leicestershire and Warwickshire Electric Power Company.
Leominster Electric Supply Co., Ltd.
Ludlow Electric Light Co., Ltd.
Market Drayton Electric Light & Power Co., Ltd.
Midland Electric Corporation for Power Distribution, Ltd.
Midland Electric Light & Power Co., Ltd.
North Wales Power Co., Ltd.
North-Western Electricity and Power Gas Company.
Oswestry Electric Lighting and Power Co., Ltd.
Ross Electric Light and Power Co., Ltd.
Shropshire, Worcestershire and Staffordshire Electric Power Company.
Stratford-upon-Avon Electricity Co., Ltd.

The total number of kWh generated in the West and North-West Midlands (Area No. 8) and the South-West Midlands (Area No. 10) Electricity Districts, as given in Table 8 of the Electricity Commissioners' publication, "Generation of Electricity in Great Britain," is as follows:—

Electricity Supply in Staffordshire, Shropshire, and Warwickshire.



Year ending March 31st.	kWh generated. Area No. 8	Area No. 10.
1922	102,101,578	178,317,760
1923	124,990,951	223,234,451
1924	149,627,632	270,320,636
1925	172,681,209	309,443,369

The 1921 Census gives the following figures for the above Administrative Counties and associated County Boroughs:—

	Acres.	Persons.	Resident families.	Buildings not containing dwellings.
Hereford ...	538,924	113,189	26,876	2,064
Salop ...	861,800	243,062	55,878	4,215
Stafford ...	741,318	1,348,877	286,013	13,494
Warwick	605,275	1,389,977	312,630	14,624
Worcester	458,352	405,842	93,210	5,015

The square dot on the map of Warwickshire indicates approximately the Hams Hall site of a new generating station to be built by the Birmingham Corporation, referred to on page 15 of the South-West Midlands Electricity District Order, 1923.

The square dot on the map of Shropshire gives the approximate position of a new capital station at Ironbridge to be erected under the provisions of the West Midlands Electricity District Order, 1925 (see page 31).

Applications for Special Orders under Section 26 of the Electricity (Supply) Act, 1919, have been lodged by the following:—

Burton-on-Trent Corporation (extension).
Sutton Coldfield Corporation (extension).
Shropshire, Worcestershire and Staffordshire Electric Power Company.
Midland Electric Corporation for Power Distribution, Ltd.
Midland Electric Light and Power Co., Ltd.
Gwynedd Trust, Ltd.
Pooley Hall Colliery Co., Ltd.

These maps complete the series which we have been publishing since October, 1925, covering England and Wales. The information which they give, together with the accompanying text, being largely derived from current official publications, is more recent than any other compilation, and is not obtainable from any other source in similar form.

Copies of the maps as published in our pages can be obtained from the Publishing Department of the Electrical Review, Ltd., at small cost; copies on a larger scale, coloured to suit individual requirements, can also be supplied.

Lighting the Village Darkness.

A New Proposal for the Electrification of Small Communities.

By V. C. SAMPSON.

Tramping across a wild stretch of Derbyshire moorland one recent afternoon, a call for refreshments was made at a well-known hostelry which is situated at the crest of one of the magnificent peaks.

The inn is an interesting old place. The interior is low-ceiled and oak-panelled, and extremely picturesque, a reminder of the long-distant past. However, an excellent and very modern meal was served. Amid such surroundings satisfaction should have been complete, but one factor marred the enjoyment. Autumn dusk had descended over the land, and mine host obligingly "lit up" a very foul, although elaborately-ornate, oil-lamp.

Watching the thin clouds of black smoke belching against the fine old oak rafters, we could not forbear saying—"What a pity that you have to put up with a light of that description; that lamp must ruin the decorations in a week."

"Aye," agreed the landlord, "it tak's some fettling doaan in t' spring, I'll 'low! But what maun I do? Theere's noa gas raand here, mon."

"Electricity," we said, enthusiastically, "will do the trick for you easily."

He looked us suspiciously. "Theere's bin monny a felly," he said, slowly, "raand here wanting to sell me one of them generating sets, as they calls 'em, but I'm noan having onny! Ingines is noan in my line! I'll use electricity—and be glad to do it!—when they brings it raand on a caart, same as old Hawky brings us t' paraffin."

We didn't carry the argument any further, mainly because the old chap's bit of sarcasm anent "bringing the electricity round on a cart" had fired an interesting train of speculation.

Well—why not?

There does not seem to be any insuperable objection to the scheme, although the application would be limited to those scattered villages, farmhouses, and wayside inns that are out of reach of the ordinary cable system.

The idea may be outlined in a very few words. Why not provide a mobile battery-charging station, and send it round on a weekly visit to different consumption points? At each of these it would serve out a ration of electricity sufficient for the following week's demands. Accumulators are now sufficiently standardised and sturdy to provide an efficient storage unit. A wide area of customers could thus be supplied at a comparatively low cost.

Energy consumption in a village community would be low, but the load factor would be fairly steady except on one or two occasions. During evening service in the church there would be a heavy, but short, demand. Again, in mid-winter the school would consume a fair amount of electricity for short periods. But, on the average, the load would be low and constant.

The installation of a separate generating plant, with attendant labour and supervisory costs, to meet such conditions, would not be a paying proposition. It is even doubtful if working costs would be covered by the revenue, apart from any consideration of overhead and capital charges. Neither is the idea of a "ring" cable—even an overhead one—much more satisfactory. These tiny villages are scattered at distances of from five up to twenty miles apart. A cable system capable of coping with such an area would entail high capital cost of installation, and excessive line losses, making the supply charges prohibitive.

Concerning this question of cost, while, no doubt, many of the farmers and the more prosperous of the inhabitants would be willing to pay handsomely for the privilege of being supplied with electricity, on the other hand farm labourers are not in a position to pay a great deal for the illumination of their cottages; but these dwellings would help considerably to make the scheme a success. Therefore, it would be necessary to compile a flat-rate schedule to meet this demand. About a shilling, or at the outside eighteenpence, a week touches the limit of the farm labourer's capacity. That sum would compare favourably even with oil-lamp light at the present price of paraffin in these out-of-the-way districts. Also, the flat-rate system of charging has one respectable advantage for the supply concern—it obviates the necessity for separate metering.

Some cheap form of current-limiter, however, would be essential. Further, it would be advisable to fix some simple prepayment device in conjunction with the current-limiter, so that abnormal demands, such as that occasioned by sickness, could be coped with adequately. On a d.c. supply this would not be difficult.

Occupants of the larger houses would be in a position to pay for their own interior wiring and fittings, of course, but it would be necessary to initiate some simple hiring scheme for the wiring of the labourers' cottages. Obviously, it would be impossible for these people to put up the first cost.

A village of the usual type consists of thirty or so cottages scattered along the road, mostly on one side

of it. The nearest railway station may be five miles away. There is a public-house at the end of the road, and the village stores, with post office attached, nearby. On a low hill, about a quarter of a mile off, stand the church and school. A two-wire overhead system would supply all these points cheaply and efficiently.

For a tiny community of this description the load would be no heavier than that of a fair-sized country house. The accumulator installation could be housed in a small brick or concrete building, and the switchgear and allied instruments would not need to be of an expensive type.

This article, of course, does not pretend to offer more than the nucleus of the scheme, and no attempt is being made at a cut-and-dried proposition; but, roughly, the schedule of requirements would be as follows:—

In each cottage there would be: Living-room, 40-watt lamp; two bedrooms, 30 watts each; outhouse, cellar, or the like, 20 watts. Total full-load requirements—120 watts. The average load (120 ÷ 4 with 30 per cent. added) would be 40 watts, and 35 hours' burning per week, averaged throughout the year, at 100 volts would equal 14 Ah weekly. This, multiplied by 30 (the number of cottages) amounts to 420 Ah per week. Next, the post-office: Shop, 150 watts; living-room, 60 watts; bedrooms, outhouses, &c., 140 watts. Total full load—350 watts. Average load, 200 watts. For 30 hours' burning—60 Ah per week. Take the inn to have three public rooms and six private ones, its requirements therefore being an average load of 350 watts for 35 hours' consumption per week. This equals 120 Ah per week. The church and schools' requirements are difficult to estimate with any degree of accuracy, but a weekly load of 100 Ah may be taken as a fair statement of the average consumption throughout the year. Allowing a margin of 20 per cent., the needs of a small village such as we have under consideration would thus be approximately 840 Ah per week.

Now, that is not at all an out-of-the-way capacity to be handled by an accumulator installation.

Taking each village to require 840 Ah this, at 100 V. is 84 kWh. At 70 per cent. efficiency, the input would have to be 109.2—say 110 kWh. A 20-kW d.c. generator would deal with this load in 5½ hours. Allowing for a "commercial efficiency" of 85 per cent., the mechanical power needed would be 30 h.p., a figure well within the capacity of a "four-tonner" engine. On this basis it would be quite easy to cover a chain of six villages per week, the labour employed being one skilled man and a youth as assistant.

The capital expenditure involved depends entirely upon the type of battery installed. Ruling price lists indicate that for a 100-V battery (with requisite booster cells) the capital cost would approximate to 70s. per 10-Ah capacity for the lead type, and 200s. for the nickel-iron type. Thus, the battery cost would be £294 or £840, according to type.

The difference is very wide, and the question arises whether the superior mechanical strength and freedom from defects and breakdowns of the more modern type compensate for this big margin. The writer believes that this is so, and also that the ease and speed of charging are substantial advantages that offset the greater cost of the nickel-iron type. But if this initial expenditure promised to be an insuperable objection, there is an alternative that is worth careful consideration. The requirement of a long and slow charge with the lead type can be met by the exercise of a modicum of mechanical ingenuity, and a certain amount of "give-and-take" spirit in the labour element.

When the writer was in Canada he was at one time concerned with the running of the electrical plant on a large fruit and mixed dairy farm in a district well off the hydro-electric area. There was a great deal of machinery on the farm, and many domestic and sundry appliances, all electrically driven. The plant consisted of a 400-Ah accumulator, connected direct to the mains, and fed by a petrol-driven generator. The charging-board was a special design of the Canadian G.E.C., and the operation was practically automatic. It was not unusual for us to start up the engine at 6 a.m., and to leave it running until 12 midnight without any attention whatever. A weekly clean-down and overhaul was all that it got during these busy periods, and the whole plant stood up to the work without breakdown of any description during the six months the writer was at that place.

It would be a simple matter to equip the mobile generator plant with a similar automatic charging-board, and to arrange for the major portion of the charge to be given while the attendant was off duty, or even asleep! Under this arrangement an eighteen-hours' charge would be possible, while still covering the chain of six villages in a week. The provision of a simple automatic alarm, connected by field-telegraph line to the man's "digs," would ensure the calling of the attendant in case of a breakdown of any description.

Premising an installation of the lead type, the cost can be taken as: Buildings, £70; battery, £300; switchboard, £30; overhead equipment, £150. Total, £550 each, making £3,300 for the chain of six villages.

A good, re-conditioned steam- or petrol-lorry chassis and engine can be purchased for round about £250; scores of similar vehicles are advertised in each issue of the motoring-trade weeklies. The charging-board would cost £85 complete, and the 20-kW d.c. generator £100. Additional fitments, roughly, £15. Total cost, £450.

Thus the total capital expenditure would amount to £3,750—say, in round figures, £4,000. House-wiring, of course, is not included in this estimate. Under present conditions, the cost of this per cottage would be about £4 all in. An additional monthly charge of one shilling is equivalent to a profit of 15 per cent. on this outlay. As an alternative, the cost of wiring could be charged to the energy consumption, and spread over a period of three years or longer. The larger houses, of course, and the various public buildings would pay for their own installations, and the profits on these would help towards the cottage installations.

Fixed charges on this capital outlay would be: Interest on £4,000, at 5 per cent., £200. "Overall" depreciation, at 12 per cent., £480; total, £680. "Overall" depreciation may require a word of explanation. It is arrived at by taking the usual accountancy figures—such as buildings, 2½ per cent.; vehicles, 20 per cent.; and so forth—and averaging, to save space.

Running charges would approximate to: Wages, man and youth, £270 per annum; fuel and oil, &c., £150; rent maintenance and repairs, £180; miscellaneous charges, £26. Total, £626. To this has to be added the fixed charge of £680, making a total of £1,300 say, for the lead type of battery.

Revenue: The six villages would approximately use annually 26,500 B.O.T. units. (Average weekly consumption for six villages, 84 kWh × 6, equals 504; × 52 is 26,208 actual or, say, 26,500.) At 15d. per unit this amounts to a revenue of £1,656 in round figures. Thus: Revenue, £1,656; charges, £1,300; profits, £356, for the lead battery. With a one-man proposition, where the proprietor runs the plant and does all the necessary work, to this must be added wages £205, and interest £200. Thus we arrive at the very handsome profit of £761. This is good enough to be an incentive to further consideration of the scheme.

This also, is for the use of a single generating set only. It is probable that sufficient ground could be covered to utilise at least two of these mobile plants, with a consequent enhancement of the profit ratio.

A slightly different treatment would be needed to meet the requirements of the single, scattered farm-houses and wayside inns. Taking, for each of such places, a weekly consumption of ten units, the separate installations would need to be of 100 amp.-hr. capacity, presuming 100-V pressure. There is marketed at the present time a neat and highly-efficient petrol-driven set, weighing about 150 lb. all in, and quite capable of dealing with this charge on a seven-hours' run. The sets are easily portable.

Equipped with, say, five such sets, the travelling supply would cover sufficient ground in the course of a week to make even such a demand a paying proposition. At each "call" the driver-mechanic would lay down

one of the portable sets and start it up. These outfits are entirely automatic in action, with a most sensitive and reliable automatic cut-out. They can be safely left to complete the charging unattended.

The lorry would travel round on a belt system, so that there would be no question of waiting or overlapping. In a week's work one such lorry ought to be capable of charging 25 or 30 installations. At 15d. per unit, the revenue would prove considerable.

Minor, but very helpful, business would consist in looking after numerous wireless accumulators, portable lamps for stable use, and so on. The amount of work waiting to be done in this line is astonishing.

The scheme appears to hold the potentialities of sound and profitable business, especially for the one-man concern. The proprietor of an electrical business in a small town would be particularly suited to carry out such an undertaking. But planned on a sufficiently broad basis, the idea is worth the consideration of a project to form a small public company, with the sole object of vending electricity itinerantly—or, as the landlord would have put it: "To go araand hawking it!"

The Works Inspection Department.

The Importance of Efficient Organisation.

By W. J. HISCOX.

The necessity for an inspecting department is becoming more and more recognised, and there are now comparatively few works where the department is not in evidence. It cannot be said, however, that in every case the innovation is a success, and this may be ascribed to the fact that the department is raised upon an insecure basis—in other words, the organisation is imperfect.

The institution of an inspecting department may emphasise the importance of inspection, but it does not necessarily ensure efficiency in inspection. The management may appreciate that inspection must form an integral part of the works organisation, but often the latter is not so devised as to permit inspection to function—in a manner to be effective.

Inspection can either retard production, or accelerate it, and as there is no value in the former result, it follows that the devising of the inspection organisation must be with a view to accelerating production. The idea exists in some quarters that inspection is for the purpose of maintaining the requisite standard of workmanship, but while this is a most important factor, it is by no means the sole aim and object. Every phase of the works organisation must to some degree assist in accelerating output, and in this respect the inspection department must be well to the fore.

The inspection organisation, to be effective, must be thorough, and when devising the system the management must know full well what it is expected to do. In very many cases the inspection department is an innovation which has to be fitted into an existing works organisation, and adjustments are therefore necessary to enable it to function freely.

Because the inspection department is an innovation, it does not follow that inspection is being considered for the first time, for although hitherto there has been no inspection department, the duty of inspection has devolved upon someone. Usually this duty has been allotted to the section or department foremen, or, in the case of a small factory, to the chief foreman or the works manager, but as time goes on it becomes apparent that inspection upon these lines is not altogether satisfactory. The people concerned have other duties to perform, and some of these are regarded as being of the greater importance. The foreman particularly is concerned with output, and he will not allow inspection to interfere with this, if it can possibly be avoided. He is therefore prone to "stretch a point" in regard to inaccuracies or indifferent workmanship, rather than permit output to suffer, and the resulting trouble usually falls upon those concerned with a later phase of manufacture.

It is obvious, therefore, that if inspection is to function effectively, it must be free from the influences of those who are primarily concerned with other matters, more or less antagonistic, and the only way of accomplishing this is to create a department concerned exclusively with inspection. This is, however, but the first step, and it is because many firms do not go beyond this first step that real effectiveness is not reached. In many factories to-day the inspection department is merely an additional obstacle in the path of progress. Instead of the details in progress passing direct from one operation to the next as heretofore, they are diverted to the inspection department, this causing delay for which there is no compensation. What happens is that time is spent in examining the details, but the findings of the inspector (unless they are favourable) are overruled, and for all practical purposes the details might just as well have progressed from operation to operation, without passing through the inspection department at all.

If inspection is to be effective, it must be carefully planned and follow a definite procedure. There must be a standard of workmanship and a limitation of tolerances, and if the details do not conform to these, they must be rejected. There is nothing to be gained in over-riding the inspector, for it inevitably means trouble and delay at a later date. It is, of course, important that the inspector be a fully-qualified man, possessing a thorough knowledge of every part and its function; able to discriminate, and prepared to accept responsibility. There is nothing wrong, however, with the practice which obtains in many works of permitting the foremen to challenge the inspector's ruling, provided that an impartial inquiry is instituted, and the final decision given by the highest works executive.

Many firms, when seeking to incorporate an inspection department with an existing works organisation, prefer to commence in a modest manner, but modesty here can be overdone. It is not to be expected that the innovation will be regarded with favour by the works officials; in fact, there is likely to be active opposition, which will not be killed until the new department has proved its worth. If the management adopts a timorous attitude, the new department is not likely to get the official support it needs, and then there are good grounds for the complaints of those antagonistic to the innovation that production is being retarded. There is nothing to be said against starting in a small way so long as that small way clearly indicates the policy of the management, and can be regarded by all as the basis of a comprehensive inspection organisation. Let the works officials see that the management means business, and they will co-operate; let the new department know that it has the support of the management, and it will rise to the occasion; but let the works officials believe that the management has no definite policy, and trouble and chaos will inevitably ensue.

Some firms commence operations by installing an inspector in the machining department, leaving other phases of inspection for future consideration. The writer has seen this attempted in several factories, but the results have rarely been satisfactory, because of the handicap under which the inspector laboured. No one would commence manufacture by doing an intermediate operation first, yet a similar proceeding is frequently attempted in regard to inspection. An inspector is appointed to examine finished machined details, many

of which have been subjected to half a dozen or more operations. It is obvious that inaccuracies can occur during any one of these operations, and also that the material itself may be defective or inaccurate, yet none of these inaccuracies are looked for until all the operations are completed. One instance may be quoted. A firm of engineers inaugurated an inspection department for examining finished machined details, and at one time several thousand turnbuckles were submitted. There were in all a dozen operations on each, and a

MATERIAL INSPECTION.

Certificate No.

Date Order No

Material From

Required for

Amount rec. Amount inspectd.

THIS MATERIAL HAS BEEN INSPECTED AND CERTIFIED O.K.

Inspector.

Fig. 1.

dozen different gauges were provided. Girls were employed in the inspection department for gauging, and the procedure was for one girl to lead off with the first operation, reject the details which did not conform to the gauge, and pass the accepted ones to the next girl, who gauged for the succeeding operation, this procedure being repeated until all operations had been gauged. The inspection of this batch occupied one week, and at the end of that time only 500 turnbuckles out of the batch of several thousands emerged triumphant. As the whole batch was required for one customer, the seriousness of the affair will be appreciated, and particularly as a definite promise of delivery had been given at the time when the details were handed over for inspection.

If an inspection organisation is to be developed gradually, it is better to commence with outside purchases, for it is in connection with material supplies that many troubles arise. It may be taken for granted that the customer who is not particular does not have too much attention accorded him, and if he accepts without protest anything sent, his suppliers will not put themselves out to give of their best. The inauguration of material inspection usually results in a high percentage of rejects, and although the suppliers may

MATERIAL INSPECTION.

Reject No.

Date Order No.

Material From

Required for

Amount rec. Amount inspectd.

THIS MATERIAL HAS BEEN REJECTED FOR THE FOLLOWING REASONS :

Inspector.

Fig. 2.

protest, it is on the score that similar material has always been accepted hitherto, and not because they disagree with the reasons for rejection. This applies likewise to manufactured parts purchased from outside, and although it is not suggested that all suppliers deliberately send inferior products, it is suggested that greater care is taken to satisfy the exacting customer, *i.e.*, the customer who insists upon a rigid inspection of all outside supplies before accepting them.

Tool inspection is another matter which should be dealt with at an early stage, and although in most works this does not come within the scope of the production inspector, in the writer's opinion it should do so. Many firms leave the matter of tool inspection to the head of the tool department, not always with the happiest of results, for the principle of an independent and critical inspection holds good here, as elsewhere. But while many firms subscribe to the principle in respect of production inspection, holding that the inspector should be free from the control of the actual producers, they do not subscribe to it with respect to tool inspection—consequently the inspector

TOOL INSPECTION.

Certificate No

Date Tool Number

Component No. Operation

THIS TOOL HAS BEEN TESTED AND CERTIFIED O.K. FOR PRODUCTION PURPOSES.

Inspector.

Fig. 3.

is in the hands of the man responsible for the making of the tool.

Even when there is a recognised tool inspector, he is usually associated with the tool organisation, and cannot therefore criticise as freely as he would wish. Thus it happens that inaccuracies are kept out of the limelight, and adjustments made which do not come to the notice of the management. This means additional costs in respect of tool production, and it is usually difficult to determine just what these additional costs cover. An independent inspector would, of course, bring about the same result, *viz.*, additional costs, but the why and wherefore would be known to the management, which in itself would tend to ensure greater accuracy in the tool room.

Operation inspection is necessary to ensure uniformity in manufacture, and a definite standard of workmanship, but to be effective it must be conducted during or immediately after every operation. Whether the details are removed to a recognised inspecting room for examination, or inspected as they come off the machine, must be left to the management of the specific factory to determine, for while one procedure may be the more expeditious in one factory, in another the reverse may be the case. It has to be borne in mind that expeditious handling is as essential in the inspection department as elsewhere, and it is of no use speeding up the

TOOL INSPECTION.

Reject No.

Date Tool No.

Component No. Operation

THIS TOOL HAS BEEN REJECTED FOR THE FOLLOWING REASONS :

Inspector.

Fig. 4.

production departments if the time thus saved is swallowed up by inspection.

If detail (or operation) inspection is efficiently carried out, there should be no need for detailed inspection in respect of sub-assemblies, although in some cases it is advisable to inspect the completed sub-assembly before sending it to the erecting shop. Many firms have assembly inspectors, but usually their presence is necessitated by lack of uniformity in the component parts, due to the inefficient inspection

of the machining operations. Bring machining inspection to a high degree of efficiency, and assembly inspection will entail but little expense—a point that is worth considering.

There is no need for an elaborate system in order to establish an inspection organisation, and it should be possible to incorporate one in the existing works organisation without a lot of adjustment. It is agreed that a recognised inspection department must be provided, this whether a definite area of the factory is allotted to inspection, or the inspectors carry out their duties in the various production departments. The *personnel* is, of course, governed by the amount of work handled, this covering, not only the volume of manufactured parts, but also the amount of handling brought about by the inspection procedure favoured.

OPERATION INSPECTION.

Certificate No.

Date Batch No Component No

Operation

Operator's Name Operator's No

No. of pieces rec. No. of pieces inspectd

THESE DETAILS HAVE BEEN INSPECTED AND CERTIFIED O.K. THEY ARE NOW AVAILABLE FOR

(Operation).

Inspector.

Fig. 5.

The inspector's signature must be the recognised authority for payment to be made for material received and work done; this means that no invoice for material purchased will be passed for payment unless there is a certificate from the inspector to the effect that the material received is as ordered; also no operator's work order will be passed for payment unless the inspector certifies that the work has been done to specification, and is to the recognised standard. The certificate may be a separate document, or the signing by the inspector of the purchasing invoice and of the operator's work order may be regarded as a certificate authorising payment.

The series of certificates reproduced were introduced by one firm with quite satisfactory results. These are in the form of tallies, attached to material or a batch of details, and nothing can be removed unless there is a tally attached. The tallies are printed both front and back, the front being utilised as an acceptance certificate, and the back as a rejection notification. The procedure is as follows: If the material (or batch) has passed inspection, the inspector attaches a tally certifying the fact, figs. 1, 3, and 5, and the material is removed to its destination. The tally is then taken off and handed to the progress office, and from there further instructions are received. If the material is rejected, a tally certifying this fact is attached, figs. 2, 4, and 6, and (except in the case of an outside purchase) the material is returned to the sender, who, upon receipt, detaches the tally, and hands it to the progress office. From there further instructions are issued, based upon the terms of the inspector's report, and the tally is again attached to the material, where it must remain until the material is again submitted for inspection. If the terms of the rejection are such as to definitely scrap the material, the tally is retained in the progress office, and is later forwarded to the costing department.

In the case of rejected outside purchases, the material is returned to the receiving station with a tally attached. The tally is taken off and sent to the progress office for recording purposes, and is then sent to the purchasing department. The material remains in the receiving station until instructions are received from the buyer regarding its disposal.

OPERATION INSPECTION.

Reject No

Date Batch No. Component No

Operation

Operator's Name Operator's No.

No. of pieces rec No. of pieces inspectd.

THESE DETAILS HAVE BEEN REJECTED FOR THE FOLLOWING REASONS:

Inspector.

Fig. 6.

Boiler Draught and Air Flow.

The Efficient use of Draught Gauges.

By CHAS. F. WADE, A.M.I.Mech.E., A.M.I.E.E.

THE use of a system of draught indication, provided that it has been properly thought out, will provide the means of very close control of combustion conditions, with the additional advantages of cheapness, simplicity, and reliability in the apparatus needed. The simple draught gauge, of either the ordinary U-tube, inclined-tube, or more elaborate dial patterns, has been in common use for a considerable period, often with but one instrument connected to one point or another in the gas circuit and showing the difference between the pressure in the latter and atmosphere. Before proceeding to describe really useful applications of draught measurements it may be well to consider what information the single gauge is capable of affording.

We will assume that an ordinary U gauge is connected to the middle chamber of a boiler and gives us a reading of 0.5 in. w.g. under correct conditions of fire thickness and best percentage of CO_2 in the gases for a given steam demand. It does not follow from this that so long as the gauge reads 0.5 in. for the same steam demand things will be as they should be. A thinner fire on the grate subjected to the same amount of draught pressure will result in a great excess of air, so that the grate speed will have to be increased out of proportion to the decreased fire thickness in order to meet the demand for steam. On the other hand, too thick a fire for best conditions under the same draught pressure will result in loss by unconsumed combustible in the gases and over the dumping bars. Again, the use of sectionalised grates and compartmented stokers will further complicate matters, so that the simple single gauge will give us little or no useful information, while to instruct the firemen to work to a fixed figure on a draught indicator, which the writer has known to be done, is merely asking for waste of fuel.

The draught gauge presents its most valuable features when it is applied in the differential pattern, using it to measure the difference in pressure between two points in the gas and air circuit of the boiler. The gauge may take the form of the ordinary U-tube or inclined-tube pattern, with one leg connected to each of the points between which it is desired to measure the pressure, or it may be of the open dial indicating or recording type. In the latter instruments one point is connected to the movement in the ordinary way while the other point is connected to the case of the instrument, which is of

airtight construction for the purpose. Two such differential gauges will be needed for the ordinary operation of the boiler (apart from special test investigations), while a third simple gauge will also be required. The accompanying diagram of a C.T.M. boiler will show how the gauges should be connected. Gauge No. 1 is of the ordinary open type, and is connected to the uptake at E in order to measure the draught initially applied to the boiler; gauge No. 2 is a differential, connected from the furnace combustion space at B

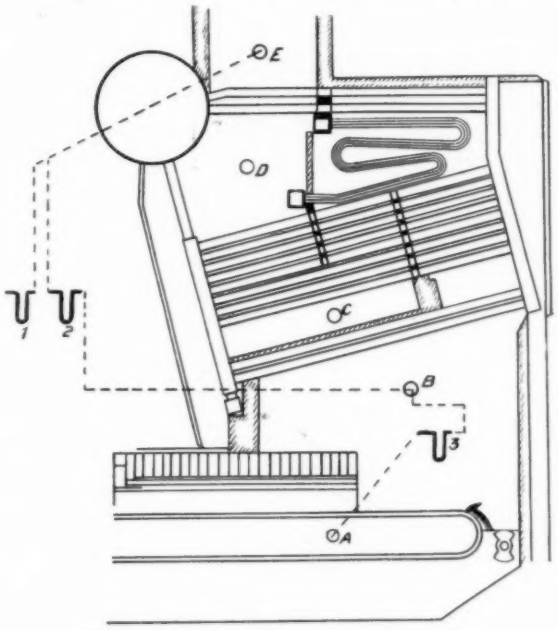


Diagram showing the Correct Gauge Connections.

right across the gas circuit to E, and serves as a measure of the air and gas flow; gauge No. 3 is the second differential, connected across the firebed from the interior of the grate or the wind box A to the combustion space at B. C and D are additional test holes provided for the purpose of localising the seat of trouble when faults may develop, but are not used for ordinary operation purposes. All three gauges should be mounted in a conspicuous position so as to be easily read from the operating floor of the boiler house, and adjacent to the steam-flow meter, so that deviations from the proper relations between the various instruments will be immediately evident. Incidentally, the mention of the steam-flow meter prompts the writer to emphasise the fact that no boiler plant can be continuously operated at best efficiency without an indication of boiler load, otherwise there cannot but be a large element of rule of thumb operation, with the usual results.

Having our gauges connected as shown it will be necessary, in the very first instance, to put the boiler into as perfect condition as regards tightness of brickwork, cleanliness, &c., as possible, for these conditions will influence very greatly the indications of the gauges, while the latter will also fulfil the important function of detecting faults of condition by their deviation from the readings obtained with the boiler in its normal state.

An interesting and important fact has to be borne carefully in mind when dealing with fuel combustion. While the number of B.th.u. generated per pound of coal or other fuel will vary very widely, the amount of heat generated per unit weight of oxygen or air used for combustion will show an inappreciable difference, from a practical point of view, over a very wide range of fuels indeed, even between such limits as fuel oil and semi-anthracite coal, the maximum variation from the average of 5,670 B.th.u. per pound of oxygen being about 2 per cent., plus or minus. In view of the foregoing, it will be realised that, irrespectively of the class of fuel being used, the correct amount of air will be always proportionate to the rate of heat transmission, and the latter will be indicated on the steam meter in terms of rate of steam generation, each pound of steam representing a given amount of heat transfer. This principle was given prominence by Bailey in America, and upon it the Bailey boiler meter is based.

Apart from the above-mentioned instrument, a differential draught gauge of the dial type may be conveniently calibrated on an additional scale in terms of the steam flow corresponding to various rates of air flow for the best conditions of furnace efficiency, the draught gauge being connected as No. 2 in the diagram. Once the correct relation between steam and air flow has been established and so long as the boiler remains physically in good condition, the fireman will only have to regulate his draught and fire thickness and speed so as to keep the pointer of the gauge at the same reading as the steam meter. Such an arrangement, however, has its limitations, in that when it is not possible to keep the relative steam and air flow at their proper values no indication is afforded as to the cause of the difficulty, which may be due either to the operation or to the condition of the boiler. By the provision of differential gauge No. 3, showing the pressure difference through the fire, we have some indication as to the condition of the fire as it affects the air supply. Thus the thickness of the fire as indicated by the coal-gate scale will not necessarily be a criterion of the presence or otherwise of bare patches, for irregularity of fire thickness will be set up from various causes, such as the hanging-up of wet slack in the stoker hopper, mixed coals, &c. Thus for a given reading on gauge No. 2, but with the steaming rate below the corresponding correct amount, patchy fires will show a reduced fall of pressure on gauge No. 3. Further, by use of the open-ended gauge No. 1, under the conditions stated this gauge will give a reading below normal.

As the boiler gas circuit is used as a sort of shunt or resistance across which the fall of pressure is taken as a measure of the flow of air, exactly analogous to an ammeter shunt, any variation in the physical state of the gas circuit will alter the significance of the reading on gauge 2. The use of a flue gas thermometer at E will serve as a guide to the source of trouble when the baffling begins to deteriorate or other defects develop. The Bailey boiler meter already mentioned, in its later forms, in addition to plotting curves of draught and steam flow, records the flue-gas temperature. It is not suggested that the CO_2 recorder should be omitted, for this provides the most ready means of ascertaining the way in which the plant has been operated over the whole 24 hours, and also will give a very good idea of the degree of efficiency of combustion which it is possible to obtain with different classes of coal, also the amount of loss which is taking place due to excess air. Thus, with a coal containing a heavily slagging ash, in order to burn it, it will be necessary to apply such a powerful draught that there is an absolute certainty of bare places on the grate, so that high CO_2 will be impossible, with increase in air leakage at the same time, if induced or natural draught alone is used. The following table is given as an aid to the interpretation of the indications afforded by a set of gauges as described, consisting of three draught gauges, steam meter and waste-gas thermometer.

READINGS WITH GIVEN STEAM FLOW.

Gauge 1.	Gauge 2.	Gauge 3.	Temp. E.	Indication of
Low.	Low.	Normal.	High.	Short-circuiting.
High.	High.	Normal.	Low.	Air leakage.
High.	High.	Low.	High.	Dirty tubes and gas passages.
Normal.	Normal.	Normal.	High.	Dirty tubes internally.
High.	Low.	High.	Normal or high.	Over-heavy fires.
Low.	High.	Low.	Low.	Thin, short, or uneven fires.

As to the seat of short-circuiting or of air leakage, temperature tests at C and D will localise the trouble; shorting at the horizontal baffle will render the reading at C higher than normal, while similar defects at the superheated cross-box baffle will cause an abnormally high temperature at D and too low a temperature at C, which in very bad cases may be lower than at D. Air leakage may be localised similarly. The stems of draught-gauge pipes must project into the gas passages exactly at right angles to the gas path, or the draught gauge will read incorrectly.

Attractive Wireless Apparatus.

Improvements in Some of the New Season's Models.

THE quality of a complete broadcast radio-telephone receiver, or the numerous components that compose the whole reproducing outfit, can be properly assessed only by measurement and aural judgment of its capabilities. Consequently, in view of the fact that demonstrations of any kind at the National Radio Show in London have been forbidden this year, it was with pleasurable anticipation that the invitations of two manufacturing concerns, to examine their new season's products and hear what their sets are capable of doing before they are exhibited at Olympia (September 4th to 18th), were accepted.

Burndept Receiving Sets.

On arrival at the Blackheath works of Messrs. Burndept Wireless, Ltd., expectations were justified, for one of the most notable features of their improved apparatus is its fine tone quality.

The new factory is already partly in production, but it was the inspection of the Research Department, under the able direction of Mr. P. K. Turner, well equipped with testing devices mostly designed and made by the company's staff, which afforded a clue to the general improvement that has been effected; it must have been a very busy section during the past six months, if the sets examined are any criterion, whilst Mr. C. F. Phillips

Fig. 1.—The "Ethophone" 3-valve Receiver.

(director) has a correct conception of the right type of receiving set needed by the public majority.

"Ethophone" apparatus has always been of a standard that commands respect, but the new models have a decidedly more pleasing tone, due to their capability of reproducing more of the lower-frequency scale. The overall dimensions of the cabinets have been reduced, and ebonite is conspicuous by its absence; most accessories are now themselves insulated so that it is unnecessary to mount them on an ebonite panel, which is deteriorated by the action of light, polished mahogany being used instead. Other points common to all sets are: simplicity of control, fixed resistances are employed, and the new polished black bakelite "Ethovernier" dials facilitate tuning adjustments; the concealed 18 to 1 friction-driven reduction gear is well made, with provision for correcting wear, and really smooth in action. Should it be desired to hear Daventry (long wave) as an alternative to the local station, a switch brings in a special circuit which is independent of the coils, and a reaction corrector is incorporated to enable the normal adjustment to be varied to suit different aerials, valves, and coils. The output is through one stage of resistance-capacity coupling and one Marconi "Ideal" transformer when more than one stage is used, whilst a master switch that disconnects all batteries also serves to give high and low power by cutting out the resistance-capacity coupled valve. The last power valve (type LL525, one of Messrs. Burndept's new valves) recently designed for reproduction with the aid of low-impedance speakers, particularly of the "cone" pattern, remains always in circuit; in fact, it governs the set, which has been built backwards from it so to speak. The grid of the last valve is operated at a negative potential of from 16 to 25 volts, and the plate voltage is specified as 120 V, for if a set is to be capable of deriving its supply of power from the domestic lighting mains it should function correctly at a fixed voltage, and tapped batteries are therefore not favoured. The "feed-back" difficulty experienced when operating under such conditions has been overcome.

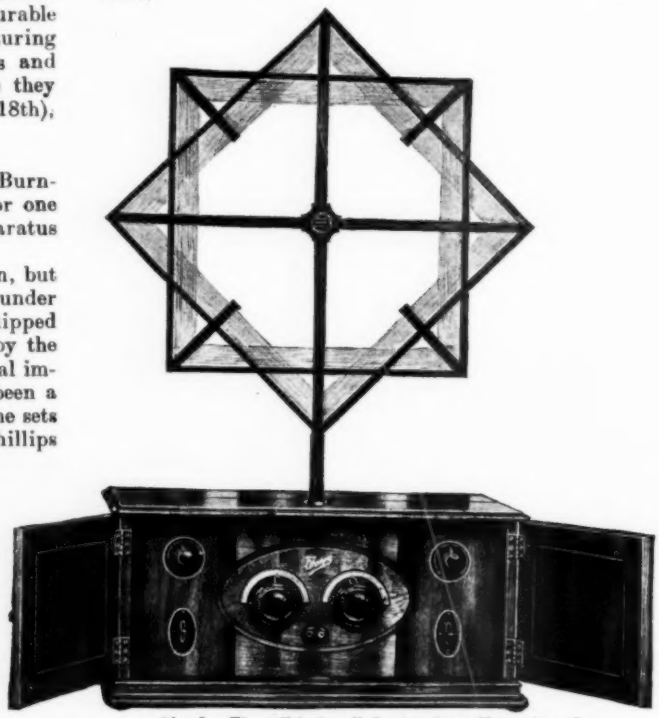


Fig. 2.—The "Ethodyne" 7-valve Super-Heterodyne Set.

The sets demonstrated comprised the 2-, 3- (fig. 1), and 4-valve models and the "Ethodyne" 7-valve supersonic heterodyne receiver, for which a new rejector frame aerial has been produced (which consists of two sets of coils on one frame, fig. 2) to obviate the employment of a tapped or loaded frame. Sufficient having been written to indicate the nature of the improvement of the sets, nothing more need be said than that the workmanship is in no degree inferior to their design.

The "Celestion" Receiver.

Since we described it over a year ago* as a loud-speaker that "ranks high amongst modern instruments

Fig. 3.—The "Celestion" Portable Loud-speaking Receiver.

of its kind," the makers of the "Celestion" have produced a receiving set specially designed to operate it, a logical method of tackling the problem, and the results

* See ELEC. REV., June 19th, 1925; page 995.

obtained are of a high order of merit. The standard set is made in two patterns, in cabinet form and in a leather case that enables the instrument to be conveniently and unobtrusively carried by hand (fig. 3); both are really self-contained, the batteries, loud-speaker, and frame aerial of special formation being concealed in the case.

Four valves are employed and, although the circuit is not described by the Celestion Radio Co. as a fancy one, it is certainly unusual in that neither are iron-core transformers used, nor is reaction employed, the elimination of which is of obvious advantage; the balanced circuit renders damping or limiting devices unnecessary in the high-frequency stage, while the l.f. stages are resistance-capacity coupled. Operation is simple, the controls consisting of two tuning condensers, one rheostat, and a start-stop switch which switches the set off when the lid is shut; a Daventry switch is incorporated when required. Realistic reproduction is obtained with ample volume, and the tone of the instrument is very good, particularly in the lower musical range. The set is out of the ordinary, and its capabilities created, on the occasion of its demonstration, a pleasant impression.

A Big Electrical Campaign.

A Joint E.D.A. and E.L.M.A. Effort.

At a meeting of representatives of the electrical Press this week, Mr. J. W. Beauchamp, director of the Electrical Development Association, and Mr. W. E. Bush, of the E.L.M.A. Lighting Bureau, unfolded the plans of an important combined "push" which is to be made during the coming winter.

It was explained by Mr. Bush that the first step to the introduction of electricity into the homes of the people was lighting. It was of no avail to attempt to induce the public to wire their homes in the first instance for electric heating and cooking. These were a natural development when once lighting had been installed. Accordingly efforts are being devoted entirely to the inculcation of the idea of electric lighting, the hope being that all the other applications of electricity will be added by easy stages. The campaign does not commence so far as the public is concerned until October, but the whole of September is being devoted to the preparation of the ground. The country has been divided into seven areas, in each of which a committee has been formed, with a paid organiser. These organisers are the only paid officials, the committees being formed by local contractors and other interested parties who are being helped by the E.D.A. to help themselves. Each committee will form "electrical circles" in the towns within its area, and it will be the task of these circles to spread the electrical gospel to all within their reach. The committees will be aided by widespread and intensive newspaper and periodical advertising, plans for which have been elaborated by the Associations. It is the aim to persuade every possible supply authority to combine with electrical traders in its area to arrange an all-electric home for public inspection, and it is hoped to have a chain of these throughout the country. Employés will be brought into the scheme, and by means of lectures will be imbued with the desire to pass on the electrical message to all with whom they come into contact. It is also intended to place before supply authorities details of assisted wiring schemes which are in successful operation, thereby urging them to emulate those good examples of a very necessary departure.

When all this preparation has been made, the greatest of all electrical propaganda will burst upon the public. The central theme is a "mammoth" competition, which is all-electric in its conception and in its rewards. It will take the form of a ballot, in which competitors will be asked to arrange in order of popularity the twelve cardinal virtues of electric lighting. The first prize is an all-electric home worth £2,000, and there are numerous other prizes ranging from complete electrical installations to single appliances. There is more in the competition than this, however. In the first place, the scheme and ballot paper are contained in an attractive and readable booklet. The reader has to absorb a great many points in favour of electricity before he (or she) can attempt to enter the competition. Moreover, to qualify for the ballot, the entrant has to go through a series of illustrations of the rooms of a house in which the lighting fittings are missing, being replaced by circles. Illustrations of many types of lighting fittings are shown separately, each with a number, and the competitor is asked to insert in each circle the number of the lighting fitting which he considers most appropriate. He can then pass on to the ballot paper at the end of the booklet. As it is the principal aim of the competition to bring the public into the electrical shops, the booklets are not being distributed in the usual manner, which would bring them into contempt. They will only be obtainable from electrical contractors, dealers, or supply authorities, and to ensure that these members of the trade will carry out their distribution in a discriminating manner, a small charge is made to them for the booklets. This, in addition, will provide them with an opportunity of contributing their small quota to the immense expenditure which the whole scheme will entail.

The programme of the scheme is being dispatched to about 8,000 interested electrical firms and individuals. It is in a very lucid and attractive form, containing pockets for booklets dealing with each phase of the campaign. Some of these phases are shop-window dressing, lectures to employés, full details of the organisation of an all-electric home exhibit, dates of the appearance of advertisements in newspapers, &c., to enable "circles" to link up their local advertising with them, and "Home Lighting News," a little periodical which will record the progress of the scheme, &c.

The campaign exhibits first-class "generalship," and the leaders should be loyally supported in the furtherance of a scheme which without doubt will lead to the advent of an immense amount of new business for all branches of the industry.

An inaugural luncheon is to be held at the Hotel Cecil on September 17th. It is anticipated that a large gathering representative of the electrical industry and the Press will attend to hear the scheme fully explained.

Electric Locomotives for Rack Railways.—Some electric locomotives of a new type, intended for use on rack railways, are in course of construction at the works of the Brown, Boveri Co., at Mannheim, Germany. One lot of engines is intended for service on a section of the Andes railroad of the Chilian Transandine Railway Co. They are of one metre gauge and designed to work with 3,000-volt direct current; the line is 72½ miles long, and comprises 11 sections (the longest being about 6½ miles) with maximum gradients of 8 per cent. on which the rack system is employed. On the remaining sections of the line, with maximum gradients of 2½ per cent., traction is effected by adhesion. The engines for this line weigh 85 tons, and are fitted with six motors, each capable of developing 235 kW for one hour with a continuous output of 195 kW, the total hourly capacity being about 1,400 kW. The locomotives are claimed to be the most powerful of their kind so far constructed. Other engines for Japan are intended for service on the Usui Pass section on the railroad between Tokio and the western port of Nijgata. The section includes a ramp about 600 yards in length with a gradient of 6.7 per cent. The line is worked on the third-rail system with 600-volt direct current, the engines being equipped with three motors having a one-hour capacity of 200 kW, and 160 kW continuous.

Business Notes.

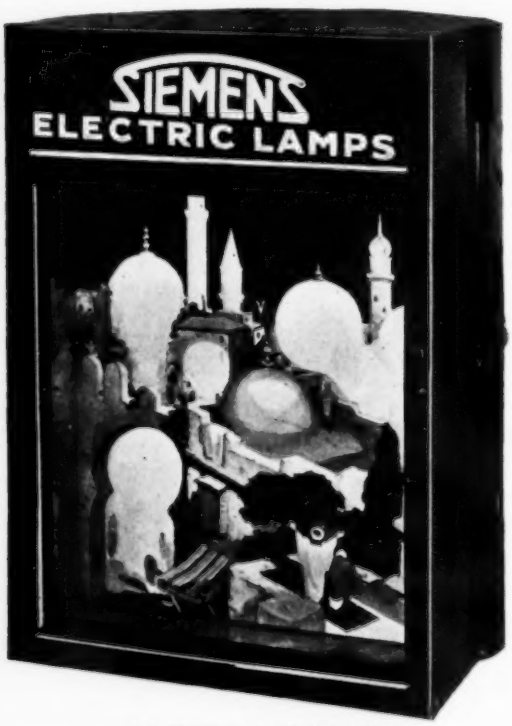
Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Lighting Propaganda.—In preparation for the coming lighting season, the BRITISH THOMSON-HOUSTON CO., LTD., has drawn up a plan of compaign by which with the aid of lamp dealers it proposes to bring the "better-lighting" idea before the public. A great deal of publicity matter has

A "Mazda" Design.

been prepared, including show-cards, folders, pamphlets, window cut-outs, &c. One of the main features of this matter is the design reproduced herewith. This depicts the well-known "Mazda" girl holding a lamp in front of a clock dial to "lighten the dark hours."

The SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., has also undertaken an intensive campaign in connection with its lamps. A number of large coloured posters have been printed for display in all the principal towns of the country. Show-cards, pamphlets, window signs, &c., are being issued to retailers, all bearing distinctive pictures. One of these, a flashing sign with a "Mecca" design, is reproduced herewith. In

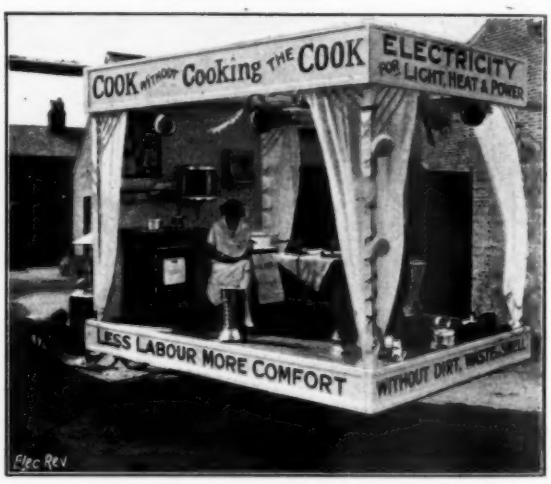


A "Siemens" Flashing Sign.

addition to printed matter and advertising in newspapers and periodicals, the company has produced a film, "Once Upon a Time," which will be exhibited in London and provincial kinemas and music halls during October and November. It may be mentioned here that the prices of the company's "Silvalux" and "Purlite" lamps have been reduced.

Lead.—In their letter dated August 28th, Messrs. James Forster & Co. state: "Closing prices yesterday were £32 17s. 6d. for August, and £32 7s. 6d. for November, against £32 17s. 6d. and £32 8s. 9d. to the end of last week. From Monday to Thursday inclusive the market was in the doldrums, and values fell each day, the fall being 15s. per ton on the week so far for August, and 12s. 6d. for November shipment. A quick change was witnessed yesterday, however, owing to rumours of buying on the part of Germany—who in the earlier part of the week was reported a seller. Consumers continue their policy of hand-to-mouth buying, and very few, we should say, have covered their requirements for forward. Consumption is quite active in the domestic trade, but electrical consumption leaves much to be desired. With a recovery, which is to be looked for, consumption in this country would soon reach last year's level. Arrivals are not so big this week as last, and very little August shipment lead has as yet been declared on the London market. Compared with the same period last year the quantities left for home absorption this year for May, June and July are 14,319 tons short, the monthly average for the three months being 16,216 against 21,319 tons."

Electricity at Littlehampton.—The accompanying illustration depicts a car which was furnished by the SUSSEX ELECTRICITY SUPPLY CO., LTD., and took part in a carnival held recently at Littlehampton. The company claims that this effort



An Electrical Tableau at Littlehampton.

shows that even small undertakings are doing their share in the popularisation of electricity. This is no doubt the case, for we have had many examples recently of the good work done in apparently unpromising districts. The tableau illustrated covers the domestic applications of electricity in a very thorough manner, exemplifying cooking, heating and labour-saving.

Social Events.—On the occasion of the Warrington Corporation Electricity Department annual outing a party of 42 visited Helsby for fishing and bowling. The total weight of fish caught was 27 lb., and included in the catch of the winner, Mr. A. Holmes, was a tench of 1 lb. 6 oz. In the bowling final W. McCabe beat N. Rothwell. The prizes were presented by the Borough Electrical Engineer, Mr. Mathias.

The first annual sports meeting of the Shoreditch Electric Sports Club (Shoreditch Electricity Department) was held at Broxbourne on August 28th. Mr. W. Weekes, the borough electrical engineer, was present, supported by the Mayor of Shoreditch and members of the Council. The events were enthusiastically contested, and "high tea" was provided at the Crown Hotel. After the presentation of prizes by the Mayor an *alfresco* concert was given. The club, which caters for both the athletic and social sides, is seeking a suitable ground. The secretary is Mr. H. R. Lloyd, Shoreditch Electricity Supply Department, Coronet Street, N.1.

A Battery-Selling Campaign.—The CHLORIDE ELECTRICAL STORAGE CO., LTD., is organising another "Exide week" immediately after the Radio Exhibition at Olympia. Advertising matter of all kinds has been prepared specially for the occasion, and the company offers prizes for shop-window displays dealing with its batteries.

Unemployment.—On August 16th the number of persons registered as totally unemployed was 1,585,000, as compared with 1,594,169 on August 9th and 1,298,285 on August 17th, 1925. The first two totals do not include persons who ceased work in the coal-mining industry on account of the dispute.

Trade Announcements.—The Lancashire and Yorkshire organisation of the Z ELECTRIC LAMP & SUPPLIES CO., LTD., has been moved to 6, St. Mary's Parsonage, Manchester ('phone: City 9258). Mr. S. W. Harrison is manager, and Mr. C. C. Derham assistant manager.

The address of the NORMAND ELECTRICAL CO., LTD., is now 3, North Side, Clapham Common, S.W.4. Telephones: Battersea 1634 and 5; telegraphic address: "Neconditi, Clapcom, London."

THE CRESSALL MANUFACTURING CO. has removed to 31-32, Tower Street, Birmingham. Telephone: Central 3463; telegraphic address: "Ohmic, Birmingham."

THE FOOLPRUFE PATENT ACCUMULATOR CO., LTD., has acquired the business of the Ace Battery Co., Ltd., and will in future carry on the whole of its battery production at its Market Harborough works.

THE BAYNES ELECTRICAL CO., LTD., Manchester, informs us that Mr. Thurley is resigning his position as director and secretary as from September 4th. Mr. W. H. Crook is to be appointed director in his place.

MR. GORDON C. LENT, electrical and radio engineer, has opened a new showroom at 24, London Road, Dover; he will be glad to receive showcards advertising radio and electrical goods.

The MULLARD WIRELESS SERVICE CO., LTD., has transferred its headquarters to Mullard House, Denmark Street, W.C.2. In addition, the following new depôts have been opened:—Leeds: 6, Whitehorse Street; Birmingham: 66½, Corporation Street; Bristol: 140c, Victoria Street,

Catalogues and Lists.—THE CRESSALL MANUFACTURING CO., 31-32, Tower Street, Birmingham.—An illustrated price list of standard type d.c. motor starters.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, S.E.18.—Price Sheet 646, describing the company's "Super-radio" h.t. dry battery.

VENNER TIME SWITCHES, LTD., 45, Horseferry Road, S.W.1.—List No. 33, dealing with "Venner" time switches for late shop-window lighting. Illustrated and priced.

THE MIDLAND ELECTRIC POWER INSTALLATION CO., Old Mill Street, Wolverhampton.—A priced and illustrated pamphlet advertising the "Mepic" heater for automobile radiators.

THE STEEL BAND CONVEYOR & ENGINEERING CO., LTD., Barker Street Works, Parade, Birmingham.—An illustrated folder dealing with steel bands for power transmission.

THE ELECTRICAL EQUIPMENT & CARBON CO., LTD., 109-111, New Oxford Street, W.C.1.—An illustrated booklet describing the "Rosenberg" welding generator.

MESSRS. HUGH J. SCOTT & CO. (BELFAST), LTD., Ravenhill Avenue, Belfast.—Two illustrated and priced catalogues dealing respectively with the company's d.c. motors and dynamos and a.c. motors.

PRITCHETT & GOLD & E.P.S. CO., LTD. (incorporating PETO & RADFORD).—Illustrated and priced booklet (W. 283) descriptive of the "P. & R." high-pressure accumulator for wireless purposes.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 200, containing illustrations, details and prices of electric lamps of all types.

THE ARORA CO., Rosebery Street, Loughborough.—An illustrated catalogue of electric fires, containing particulars and prices of a number of new designs.

THE VACUUM OIL CO., LTD., Caxton House, Westminster.—Nos. 14 and 25 of the "Gargoyle Technical Series," dealing respectively with "The Lubrication of Laundries" and "Ring and other Bath-Lubricated Spindles in Textile Mills."

The WATLIFF CO., 87, Cambridge Road, Kilburn, N.W.6.—A price list of commutators for fractional h.p. motors and automobile dynamos.

The HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15.—A new showcard depicting several types of "Hart" radio batteries and a number of well-known operatic characters.

Bankruptcy Proceedings.—A. W. PEGRUM (trading as "Economia"), electrical contractor and general merchant, 258, High Holborn, W.C.—The first meeting of creditors was held at Carey Street, W.C., on August 23rd, before Mr. Walter Boyle, Senior Official Receiver. According to the debtor's statement,, he started the business in August, 1922, with £700 capital. Owing to lack of capital, the trading had never paid, and a proposal to raise some by converting the business into a limited company came to nothing. On August 6th, when the landlord distrained for rent due, £275, the whole of the stock and effects were sold, and realised only £150, although they were valued at £800 by the debtor. He roughly estimates his liabilities at £2,000, and has no assets. In the absence of any resolution, the case was left in the hands of the Official Receiver, who said he should apply in due course for an order of adjudication in bankruptcy.

W. J. WARREN, wholesale electrical factor, 66, Victoria Street, S.W., trading as "Coleman & Warren."—This debtor attended before Mr. Registrar Francke at the London Bankruptcy Court on August 24th for public examination upon accounts showing liabilities of £1,728, against assets valued at £164. He stated, in reply to Mr. Gaine, Official Receiver, that he started business in April, 1923, with £250 capital, and adopted the style of "Coleman & Warren," because he had reason to believe that a Mr. Coleman would join as a partner. The negotiations fell through, but subsequently he was joined by a Mr. Clark, who provided a capital of £900 in cash; the business was not very successful, and in April, 1925, the partnership was dissolved, witness paying his partner £100 in respect of his interest in the assets. He (debtor) carried on alone until last July when, as the result of pressure by creditors, several of whom had obtained judgment against him, he filed his own petition. He attributed his insolvency to general trade depression and to irregularities on the part of his late manager. The books of account were admittedly imperfect, and did not contain a record of his drawings. The debtor said he was never really solvent, as he had to borrow from his wife and relatives soon after the start, and had never been in a position to repay the loans. The examination was concluded. The following are creditors:—

	£		£
Bernard & Co.	39	Lighting, Heating & Glass, Ltd.	44
Barclay's Bank, Ltd.	205	Michels & Sohne (Cologne) ...	33
Cranmore & Co., Ltd.	33	Watshams, Ltd.	64
Chapman, F. W.	21	Warren, Mrs. G. E.	500
Charlesworth, Peebles & Co. ...	50	Warren, F. W.	218
Clerk, H. E	75		

J. H. WICKETT, electrical engineer, 17, Albion Street, Stratford, E.—The public examination of this debtor was held on August 24th, before Mr. Registrar Francke, at the London Bankruptcy Court, the accounts showing total liabilities of £1,217 (unsecured £406), and assets "bad book debts, £43." Questioned by Mr. Gaine, Official Receiver, the debtor stated that he was employed for 24 years as an electrical engineer, and in October, 1921, purchased a business being carried on as Paterson & Co. for £350. The trading was not a success, and in March, 1924, finding himself in debt to the extent of £1,500, and being unable to continue any longer, he sold the business for £500, which was used in part liquidation of the liabilities. Witness afterwards acted as manager for the purchasers until May, 1925, and was now employed as an engineer at a weekly salary. The debtor attributed his failure to keen competition, heavy overhead charges, and high cost of production. The examination was concluded.

H. G. SELLERS, trading as "R. Sellers," 72a, Spital Hill, Sheffield, electrical engineer.—The public examination of this debtor was held recently at the County Court Hall, Sheffield. The liabilities were returned at £221, while the assets were estimated to realise £10. Debtor attributed his failure to bad trade last year. He was questioned with regard to two partnerships which only lasted for a short time, and the examination was closed.

G. E. APPLETON, 58, Leander Road, Thornton Heath, Surrey.—The following are creditors herein:—

	£		£
Adams, S. G.	32	Drage, D., & Sons, Ltd.	37
Allen, Foster & Co., Ltd. ...	43	Harris, F.	73
Bennett, H.	50	Richardson, H. G. (Miss) ...	100
Dawson, H.	75	Whiteman, W. H.	100

J. L. R. JENSEN (Jensen & McNicol), wireless accessories factor, 149a, Seabank Road, Wallasey.—Last day for proofs for dividend, September 11th. Trustee, Mr. E. D. Symond, Official Receiver, 11, Dale Street, Liverpool.

E. H. TANSEY, wireless dealer, 65, Factory Road, Hinckley.—Last day for proofs for dividend, September 11th. Trustee, Mr. E. Barlow, Official Receiver, 1, Berridge Street, Leicester.

Company Liquidations.—RADIO PHONOPORE & ELECTRICALS, LTD., 58, Coleman Street, London, E.C.2.—The following are creditors in this liquidation, particulars of which recently appeared in these columns:—

	£		£
Adair, Ltd., F.	57	Lucas Furnaces, Ltd.	37
Ashurst, Morris, Crisp & Co. ..	28	Metropolitan Electric Supply	
Automatic Coil Winder Co., Ltd.	61	Co., Ltd.	85
B.D. & Co.	67	Micanite & Insulators, Ltd. ...	113
Barclay's Bank, Ltd.	353	National Provincial Bank, Ltd.	55
Bayliss, H. W.	1,191	New Phonopore Telephone Co.,	
Buck & Hickman, Ltd.	38	Ltd.	124
Camden Cardboard & Box		Newby & Sons	32
Works, Ltd.	23	Northern Steel & Magnet Co. ...	68
Canning, W., & Co., Ltd. ...	21	Paragon Rubber Manufacturing	
Case, A.	67	Co., Ltd.	704
Clark, Hunt & Co., Ltd. ...	46	Pawson, M.	609
Dunn, Ltd., M.	1,317	Roebuck's Advertising Service	23
Flury, E.	137	Rollet, H., & Co., Ltd. ...	47
Gas Light & Coke Co., Ltd. ...	88	Slingo, —	1,000
Hanson, A. B., & Co.	41	Stedman, Crowther & Co. ...	22
Heath, S., & Sons, Ltd. ...	790	Troy, F., & Co	118
Heckford, A. E	32	Watson, Saville & Co., Ltd. ...	80
Kirse Bros. & Co., Ltd. ...	129	Westminster Bank, Ltd. ...	210
Jackson, Fixley & Co.	160	Winus, W., & Co., Ltd. ...	27
London Electric Wire Co. and		Parrott, G.	1,600
Smiths, Ltd.	34		

CASTELLINA CO., LTD., Great Marlborough Street, London, W., alabaster importers and radio and electrical dealers.—The adjourned meeting of the creditors in this matter was held recently, when the chair was taken by Mr. E. W. Smith, of 49, London Wall, E.C., the liquidator. He said that he had been in consultation with the debenture holders and had nothing further to report. After some discussion it was decided that the voluntary liquidation of the company should be continued with Mr. Smith as liquidator.

COGENT ELECTRICAL CO., LTD.—Winding up voluntarily. Liquidator, Mr. B. M. Hanmer, 24-26, North John Street, Liverpool. Meeting of creditors September 9th, at the Liquidator's offices. Particulars of claims to be sent in by September 23rd.

ELECTROPHONE, LTD.—A meeting of members is called for September 29th, at 33, Old Bond Street, W.1, to hear an account of the winding up from the liquidators.

Book Notices. — "Cardiff Facts Worth Knowing" (20 pp.) Cardiff: The Development Agent.—This illustrated booklet contains in succinct form a great amount of information regarding the real capital of Wales. It naturally deals mainly with Cardiff as a port, but there are a number of interesting facts relating to other matters. It is stated, for instance, that Cardiff is the second best telephoned city in the United Kingdom; that it has 371 miles of electricity supply mains, an annual consumption of 30,314,374 kWh, and 14,819 electricity consumers; and that there is 34 miles of tramways.

"Royal Technical College, Glasgow." Calendar for the 1926-27 session. Glasgow: The College. Price, 2s. 6d.

"Science Abstracts" (A and B). Vol. XXIX. August 25th, 1926. Part 8. London: E. & F. N. Spon, Ltd., Price, 3s. each.

"*Journal* of the Institution of Engineers (India)." Vol. VI. July, 1926. Calcutta: The Institute. Price Rs.50 per annum.

"*Journal* of the South African Institution of Engineers." Vol. XXV. No. 1. August, 1926. Johannesburg: The Institution. Price 2s.

Small Utility Tools.—An interesting range of Val D'or tools is being displayed during the fortnight ending September 4th, at 10, Spring Street, W.C.2, by Messrs. Henderson and Lawson. The tools are suitable for the small workshop, and Messrs. Henderson & Lawson have adapted some to their battery-repairing department.

Unemployment in Germany.—The Berlin correspondent of *The Times* states that the returns of registered unemployed in Germany during the first fortnight of August again show a decrease. The total number of persons in receipt of relief decreased from 1,652,000 on August 1st to 1,604,000 on August 15th. The returns from the Berlin employment exchanges also show an improvement. Last week the number of unemployed registered in the city was 267,798, compared with 270,421 the week before. Since the beginning of July there has been a total decrease of 10,500.

The German Radio Industry.—According to the *Tägliche Rundschau* (Berlin), employment in the German radio industry has been very favourable during the past few weeks, in spite of the fact that in former years August has usually brought with it a slackening in demand. The increase in the number of users has led to a considerable improvement in sales, in crystal sets especially. On the other hand, business in valve sets has been somewhat smaller than was expected, mainly owing to the reserve of country buyers. The difference in business in crystal and valve sets is particularly clearly illustrated by the fact that the number of firms manufacturing crystal sets and parts has further increased during the past few months, while a decrease has taken place in the number of firms manufacturing valve sets owing to bankruptcies and suspensions of activity. Export business is said to be but small on account of the patent licences which have been granted to foreign firms by the Telefunken-Gesellschaft. Great hopes are entertained regarding the results of this year's wireless exhibition.—*Reuter's Trade Service* (Berlin).

Washing Machines in the United States.—Figures prepared by the American Washing Machine Manufacturers' Association, and published in the *Electrical World*, show that during 1925 a total of 882,499 washing machines of all classes were sold in the United States. By far the greatest proportion of these were electrical. The details are as follows:—Electric washers, 733,220; hand-power machines, 93,758; gas and power machines, 35,745; and water-power machines, 20,778. The sales for the first half of the current year show further progress. The grand total was 511,239, as compared with 428,503 in the first six months of 1925. Of this total 411,570 were electric washers; this was the highest figure ever reached by six-monthly sales.

A Dutch Lighting Association.—A Dutch Association of Lighting Specialists has lately been formed in Amsterdam, its object being to encourage the development of better lighting in Holland. The new body will also represent the Dutch interests on the International Lighting Committee.

U.S. Aluminium Trust Attacked.—Mr. George Haskell, president of the Bausch Machine Tool Company, of Springfield, Massachusetts, has filed a suit under the Sherman Anti-Trust Act claiming $15,000,000 (£3,000,000) damages from the American Aluminium Company and 11 defendants, including Mr. R. B. Mellon, brother of the Secretary of the Treasury. The complaint alleges that the defendants conspired and combined to monopolise aluminium and the manufacture and sale of aluminium within all the United States territories, and induced the late Mr. J. B. Duke to withdraw from plans already maturing to supply the complainant with electric power from his plant on the River Saguenay, Quebec, for manufacturing aluminium from bauxite.—*The Times.*

The Buenos Aires Subway Question.—The August *Review* of the Bank of London and South America states that no progress has been made by the Buenos Aires Municipal Council in the matter of the subways which are to be made by the Anglo-Argentine Tramways Co., Ltd., in accordance with the terms of its concession. The company has stated that it is impossible for the work to be carried out if the Council refuses to allow it to increase its fares from 10 to 15 cents. A section of the Council blames the company for the delay which has taken place, for the subways are urgently needed, but the principal organs of the Press and public opinion have condemned the attitude adopted by the Municipality.

Prospective Brazilian Telephone Contracts.—The Brazilian Federal Government, having entered into an arrangement for the construction of an additional 182 miles of telephone lines in the Province of Bahía, will shortly call for tenders for supplies. The class of material required will be No. 10 copper wire for 100 miles and No. 12 "extra best-best" galvanised iron wire for 82 miles of the lines.—*Reuter's Trade Service* (Rio de Janeiro).

Preference for Australian Manufactures.—The Government has decided to introduce legislation to compel municipal and shire councils to give locally manufactured articles the preference—30 per cent. over foreign and 20 per cent. over British goods—already allowed in Government contracts.—*Reuter* (Sydney).

A Polish Exhibition.—It is proposed to hold an exhibition of power, lighting and heating apparatus in Warsaw during December and January next. The show is being organised by the Polish Fair Co., Wierzbowa 11, Warsaw.

The Canadian Radio Industry.—The total Canadian production of radio apparatus, accessories, and batteries during 1925 was valued at $5,548,660. The statistics for the year show a steady development of the industry and a tendency toward production of complete sets rather than parts. About 48,500 complete sets, valued at $2,196,000, were made. The production of valves was double that of the previous year, and amounted to $1,299,680, the value of all other parts being lower than in 1924. Of firms manufacturing radio apparatus and equipment, six engage solely in that production, nine make them in conjunction with the manufacture of other electrical goods, and 12 battery manufacturers report production for radio service. Imports of radio apparatus and parts into Canada during 1925 totalled $3,552,530, of which the United States supplied $3,358,300. As exports were practically negligible, the apparent consumption of radio apparatus amounted to $9,101,200.—*Commerce Reports.*

Australian Engineers' Hours.—The new Federal Arbitration Court, which was recently given increased powers to settle labour disputes, opened on August 24th its hearing of the test case raised by the application of the Amalgamated Engineering Union for a forty-four hour week. The application is supported by the Australian Trades and Labour Councils and various unions, and is opposed by the Federated Council of Employers, manufacturers, graziers, colliery and steamship owners, and others. The employés contend that the Governments of New South Wales, Queensland and Western Australia are in favour of a 44-hour week, and that this important and vexatious question must be settled.—*Reuter* (Melbourne).

Catalogues Wanted.—Thanet Electric Factors, Ltd., Prospect Place, Broadstairs, asks for manufacturers' catalogues and prices.

South Wales Engineering Exhibition.—Applications for space in this exhibition, which is being held from November 24th to December 4th, should be sent to Mr. M. Price, Secretary of the South Wales Institute of Engineers, Park Place, Cardiff, before September 30th.

Chinese Notes.—The *Chinese Economic Bulletin* states that the Yao Yuan Electric Light & Power Co., which was organised in 1924 at Hofei (Anhwei province) but forced to suspend operations, is now active again, and proposes to purchase machinery and other materials in the near future.

As the result of agreements between the Shanghai Mutual Telephone Co., Ltd., and the Telephone Administration, and between the latter and telephone offices outside Shanghai, a long-distance telephone service was commenced recently between the International Settlement and the French Concession and Wusih, Soochow, Nansiang, Nantao, Kiangwan, and Woosung.

The Shanghai Tramways Co. reports a net profit of £72,159 for 1925. A dividend of 10 per cent. is paid and £5,169 is transferred to reserve.

The Canton Government has opened its radio-telegraph service to private business. Messages can now be dispatched to a number of cities.

United States Electrical Exports.—The recently-issued statistics of the June foreign trade of the United States show that the total value of electrical goods of all classes exported during that month was $8,591,574, as compared with $5,940,813 in June last year. The most remarkable increase occurred in the case of telephone switchboards, the total jumping from $31,444 to $1,427,660. Apart from this phenomenal feature radio apparatus was the most important class; the total value of exports was $888,792, as against $670,605 in June, 1925. The exports of bare copper wire at $294,037 were more than doubled. Motors of all classes showed improvement, the total exports in this group amounting to $591,285, as compared with $354,598. The greatest fall was in the exports of ignition apparatus, from $394,899 to $139,731. There were, however, only 12 decreases among the 67 separate items.

For Sale.—Woolwich Corporation Electricity Department invites offers for one 250-kW G.E.C. motor generator. (See our advertisement pages to-day.)

Copper, Lead, and Rubber Prices.—Messrs. F. Smith and Co. and Messrs. James & Shakespeare report, August 31st: No change in copper prices.

Messrs. James & Shakespeare report, August 31st: English pig lead, £34 5s., 10s. inc.

Messrs. Edward Till & Co. report, August 31st: India rubber, Para fine, 1s. 8d., ¼d. inc.

Lighting and Power Notes.

Australia.—LAUNCESTON (TASMANIA).—The report on the working of the city electricity undertaking (engineer: Mr. R. J. Strike) for the year ended June 30th, 1925, records a total income of £63,930, as compared with £59,517 in the preceding year. Working expenses amounted to £45,196, as against £44,426, leaving a gross profit of £18,734 (£15,091). Interest and sinking fund charges amounted to £15,448, leaving a surplus of £3,285, against which was charged a deficit from the previous year of £557, the balance of £2,728 being transferred to reserve. The sales of electrical energy increased by 1,128,633 to 5,964,709 kWh.

Bury St. Edmunds.—NEW PLANT.—The Town Council has received sanction to the borrowing of £4,050 for extension of the boiler-house plant at the electricity works.

Continental. — RUSSIA.—The North-Western Industrial Bureau has asked the Volkhovstroi to take steps to begin the distribution of electricity from the Volkhov hydro-electric power station to the extent of not less than 20,000 kW by November 1st at the latest.—*Reuter's Trade Service* (Moscow).

FRANCE.—The plant at the power station at Sainte Tulle of the Société de l'Energie Electrique du Littoral Mediterranean has recently been increased by the addition of a steam turbo-alternator of 10,000 h.p. and one of 15,000 h.p. The company is establishing a 120,000-V transmission line between Sainte Tulle and Bancairon.

SPAIN.—La Compania Sevillana de Electricidad is raising £400,000 of new capital with the object of financing the establishment of a new hydro-electric station of 124,000 h.p. to utilise the water power of the River Cala at a point about 20 miles from Seville. The new plant will supply the Provinces of Seville, Cadiz, Huelva, and Malaga. Work is well advanced and is expected to be completed early next year.

ITALY.—An agreement has been concluded between the Sicilian sulphur producers and the Società Generale Elettrica della Sicilia whereby the sulphur mines of the island will be electrified. A large steam power plant will be erected at Catania, and electricity transmitted at 40,000 V to transformer stations at Castrogiovanni, Saltanissetta, Sommatino, and Campofranco, from which secondary lines at 10,000 V will run to the principal mining centre. The scheme will take three years to complete, and will have about 310 miles of line. The estimated cost is 35,000,000 lire.

GERMANY.—According to *Commerce Reports*, the total production of electricity undertakings in Germany during 1925 was 11,890,000,000 kWh, which was an increase of 2,840,000,000 kWh, or about 31 per cent., over 1924.

Easingwold (Yorks.).—STREET LIGHTING.—At the annual meeting of ratepayers it was decided to change over from gas to electric street lighting, and a tender by Messrs. J. C. Bannister & Co. for lighting by fifty 100-watt lamps at £2 per lamp was accepted.

Fleetwood.—LOAN.—The Town Council has applied for sanction to a loan of £18,662 for electricity purposes.

Glasgow.—YEAR'S WORKING.—We have received from Mr. R. B. Mitchell, engineer and manager of the Corporation electricity undertaking, a copy of the 34th annual report on the working of the undertaking covering the year ended May 31st last. The revenue account shows a total income of £1,195,003, as compared with £1,242,119 in the preceding year, a decrease of £47,116, which is attributed to the depressed trade conditions generally. The working expenditure, however, decreased by £50,141, from £651,434 to £601,293, resulting in a slightly increased gross profit of £593,710, as against £590,685. Interest on loans absorbed £258,109, sinking fund £261,369, and depreciation £103,560, leaving a net deficit on the year's operations of £29,329. This was met by a sum transferred from reserve, which now stands at £62,480. There was a surplus of £11,772 in the previous year. The capital expenditure during the year amounted to £524,127, bringing the total expenditure on the undertaking up to £7,887,315. The chief items were £176,022 for additions to Dalmarnock station and £224,956 for mains and cables. The sales of electrical energy increased from 174,917,610 to 181,747,635 kWh, and the maximum supply demanded from 85,700 to 91,700 kW. The average gross receipts per kWh sold were 1.535d., as compared with 1.663d. in 1924-25, and the cost per kWh sold 1.573d., as against 1.647d.

In connection with the Dalmarnock station the report states that the building extensions to the turbine room, switch house, and boiler house are now complete, and all plant practically erected. The first of two 21,000-kW turbo-alternators was put on full load in March, and the second in July. The switchgear has also been completed and put into commission. The erection of the boiler plant is well advanced, and will be in operation by September. Five new sub-stations were put into commission during the year, and six miles of l.p. and 15 miles of h.p. feeders were laid, in addition to 24 miles of distributors.

REFUSE WORKS.—The Corporation Cleansing Superintendent reports that good progress is being made with the erection of the new refuse power works at Govan. In consequence, however, of the extra work required, due to difficulties encountered with the foundations, and to the alterations consequent upon the Committee's decision to install 50-cycle plant, with frequency changers, instead of 25-cycle plant, as originally contemplated, the opening of the new station will be considerably delayed.

WIRING OF SMALL HOUSES.—Under the electricity department's wiring scheme 120 houses were wired during June and July, bringing the total to date to 2,465. The number of applications for hire of appliances during June and July was 188, making the total to date 10,583.

Guiseley (Yorks.).—STREET LIGHTING.—The Urban District Council has entered into an agreement with the Yorkshire Electric Power Co., Ltd., for lighting the streets by electricity in place of the gas lighting hitherto used.

Huddersfield.—NEW PLANT.—The Electricity Committee has decided to install a 5,000-kW set to replace sets which have been scrapped.

Irish Free State.—DUBLIN.—The City Administrative Commissioners are considering proposals with regard to the extension and development of the city electricity supply, at a cost of approximately £500,000, and an application is to be submitted to the Free State Government for sanction to expend that amount. Steady progress has been made in the development of the electricity supply during the past few years, the output now being double that of 1917, so that the maximum capacity of the existing plant has been almost reached. Under the housing schemes instituted by the Commissioners, new residential and shopping areas are being added to the outer suburbs, and there is a constant demand for increased supply. The proposed extensions will include additional machinery and plant at the Pigeon House Power Station, one-fifth of the loan being absorbed in this way; it is proposed to devote another fifth to interconnecting the city system with the supply from the Shannon hydro-electric scheme, including the provision of transformers, buildings, &c.; and the remainder of the money, probably about £300,000, will be spent on the distribution network, strengthening the existing cables, and affording supplies to the districts of Kilmainham, Inchicore, Chapelizod, and Cabra.

Keighley.—LOAN SANCTIONED.—The Corporation has received sanction to the borrowing of £50,000 for mains and services.

London.—PROPOSED CHANGE-OVER.—The Notting Hill Electric Lighting Co., Ltd., has applied to the London County Council for its consent to an alteration in the system of electricity supply by the company to 230/400 V., a.c., 50 cycles, 3-phase, 4-wire. If the proposal is approved, the change will only apply to the north-west portion of the company's area in the first instance.

Maidstone.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £10,000 for mains extensions.

Maidenhead.—ELECTRICITY SUPPLY.—The Electricity Commissioners have informed the Rural District Council that permission has been given to the Cookham and District Electricity Corporation, Ltd., to erect overhead cables, and has asked the Council to withdraw its objections. The Council has decided to comply with this request.

Manchester.—EXTENSION OF SUPPLY.—According to the *Manchester Guardian*, the General Purposes Committee has recommended the City Council to apply for permission to supply electricity for public and private purposes within the parishes of Northenden, Northern Etchells, Styal, and Ringway, and part of the parish of Baguley.

Millom.—ELECTRICITY SCHEME.—At a meeting of the Urban District Council, on August 18th, a proposal to defer for six months the carrying out of an electricity scheme at a cost of £11,500 was rejected, and it was decided to proceed with the scheme without further delay.

Preston.—YEAR'S WORKING.—The report of the borough electrical engineer (Mr. J. F. Simpson) on the working of the Corporation electricity undertaking for the year ended March 31st last shows a total income of £130,986, as compared with £105,542 in the preceding year. Working expenses amounted to £72,154, as against £64,176, leaving a gross profit of £58,832 (£41,366), to which was added a Government grant of £8,796, making a total of £67,628. Interest and loan charges were considerably heavier at £80,817, as compared with £34,573, and capital expenditure charged to revenue amounted to £2,127, leaving a net deficit of £15,316, as compared with a surplus of £7,979 in the preceding year. The capital expenditure during the year amounted to £197,082, the chief items being £98,154 for plant, machinery, &c., at the Ribble power station, and £91,827 for main transmission lines and distribution. The sales of electricity increased by 88 per cent., from 8,105,216 to 15,250,029 kWh. An "electric home" tariff has been introduced, whereby consumers can obtain supplies at an "all in" price not exceeding 1½d. per kWh. Arrangements have been made to install a third 12,500-kW set.

ELECTRICITY SUPPLY PROGRESS.—Good progress is being made with various electricity extensions. The Blackburn intercommunication cable will be completed shortly, but as new equipment will have to be installed, it will be a few months before it is ready for service. Progress is also being made in connection with the service to Longton, Hutton and Howick, and Hoole, the total area to be supplied being over 40 square miles. It was hoped to supply Blackpool with electricity

this winter, but as the installation of the line has been delayed, it will probably be next summer before the scheme is completed.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Finchley.—Lighting: From 4¼d. to 4¼d. per kWh.

Chester.—Lighting: From 4¼d. to 4¼d. per kWh. Bulk supplies: The charge of 25s. per kW demand per quarter to 20s. per kW.

Crook (Co. Durham).—Prepayment meters: A rebate of 1d. for each complete 1s. collected in the meters.

Rochdale.—Loans.—The Electricity Committee has obtained sanction to the borrowing of £6,823 for the installation of a rotary converter, and is applying for sanction to a further loan of £59,000 for various purposes, £32,000 being for mains and services.

Scarborough.—Loan Sanctioned.—The Town Council has received sanction to a loan of £175,000 for the purchase of the local electricity undertaking.

South Africa.—Wellington.—According to the *South African Engineer* the power available from the electricity undertaking at Wellington is insufficient to meet the demands of new consumers, and the town is faced with three alternatives for improving the position. One is to install another gas-engine and generator, at an estimated cost of £6,000. Another is to apply for an extension of the power lines of the Electricity Commission shortly to supply Paarl from Salt River. The third proposal involves damming the Wit River at the top of Bain's Kloof and erecting a hydro-electric station. The cost is estimated at £50,000. The last scheme is favoured, but has, however, so far failed to secure the approval of the Electricity Supply Commission.

Southend-on-Sea.—New Plant.—In connection with the Town Council's proposal to install additional plant at one of its electricity works, the *Southend Standard* reports that at a recent meeting of the Town Council a communication was received from the Electricity Commissioners sanctioning a loan of £13,485 for an additional Diesel engine, provided the Council completed the scheme recommended by Mr. Rider or took a supply in bulk to meet future requirements. The Commissioners also intimated that they were not prepared to sanction the installation of any additional plant at the existing stations. The matter was referred back.

Salford.—Year's Working.—The report on the working of the Corporation electricity undertaking (engineer: Mr. S. J. Watson) for the year ended March 31st last records a total income of £287,899, and working expenditure, including bulk supply purchased from Manchester Corporation, of £151,364, leaving a gross profit of £136,536. The figures for the preceding year were:—Income, £281,595; working expenses, £171,173; gross profit, £110,421. To the gross profit was added interest on investments of £5,593, and a Government grant of £13,260, making a total of £155,389 available. After meeting capital charges, there was a net surplus of £44,236, which was disposed of as follows:—Depreciation and renewals fund, £30,236; transferred to the borough fund, £14,000. The previous year's working resulted in a net surplus of £27,061. The capital expenditure during the year amounted to £194,113, the chief items being £22,982 for machinery and plant at Frederick Road station, £118,369 for the Agecroft power station, and £42,053 for mains and services. The sales of electrical energy increased from 44,744,494 to 49,776,217 kWh. and the maximum supply recorded from 18,647 to 22,034 kW. The average price obtained per kWh fell from 1.49d. to 1.37d. The Agecroft power station was formally inaugurated in September, 1925.

Stanley (Co. Durham).—Inauguration of Supply.—An electricity supply for the district was to be formally inaugurated on Wednesday last (September 1st). Electricity is obtained in bulk from the Cleveland and Durham Electric Power, Ltd., and transformed at the Urban District Council's substation to 250 V for lighting and 440 V for power. The total cost of the scheme was £18,000. The electrical engineer is Mr. E. H. White.

Tramway and Railway Notes.

Australia.—Launceston (Tasmania).—The accounts of the city tramway undertaking (superintendent: Mr. R. J. Strike) for the year ended June 30th, 1925, show a total income of £50,531, and working expenditure of £35,460, leaving a gross profit of £15,071. The previous year's figures were: Income, £54,886; working expenses, £37,181; gross profit, £17,705. Interest and sinking fund charges amounted to £9,421, leaving a net surplus of £5,650, as compared with £7,731 in 1923-24. The number of passengers carried increased by 31,276 to 4,573,275, and the car-miles run fell from 472,701 to 463,718.

Burnley.—Tramway Extension.—The Corporation has approved a tramway extension from Belvedere Road to the junction of Brunshaw Road and Stroyan Street, at an estimated cost of £9,625.

Keighley.—Year's Working.—The financial statement issued at the conclusion of the first year's working of the Corporation railless-car service (replacing the former railed tramways) shows a loss of £2,622 after paying capital charges. The gross profit was £2,055. The loss has been met out of the motor-'bus reserve or renewals account. On the old tramway system there is a deficit for the year of £2,312, due to the heavy capital expenditure still outstanding. This has been met by the transfer of £1,571 from the tramway reserve or renewals fund, and £741 from the motor-'bus reserve fund.

London.—Extension of Service.—*The Times* reports that from September 1st the L.C.C. tramway service now running between Victoria and Tooting Junction (No. 8) will be extended to Lower Mitcham, thus resuming the use of the tramway track between Fair Green and the Cricket Green.

Preston.—Year's Working.—The accounts of the Corporation tramway undertaking (general manager: Mr. H. Clayton) for the year ended March 31st last record a total revenue of £85,831, as compared with £84,916 in 1924-25. Working expenses amounted to £67,723, as against £70,028, leaving a gross profit of £18,108 (£14,889), to which was added bank interest of £324, and a payment of £1,400 from the Electricity Committee for rent of power station, making a total of £19,832. Capital charges and capital expenditure charged to revenue absorbed £17,466, and there was a net profit of £2,366, as compared with £1,718 in the preceding year. The number of passengers carried increased from 15,052,428 to 15,405,345, the car-miles run from 1,214,817 to 1,214,842, and the total revenue per car-mile from 16.776d. to 16.894d.

Salford.—Year's Working.—The report on the working of the Corporation tramway undertaking (general manager: Mr. J. S. D. Moffett) for the year ended March 31st last shows a total revenue of £526,802, as compared with £520,978 in the preceding year, and working expenditure of £439,531, as against £412,312, leaving a gross profit of £87,271 (£108,666) to which was added revenue from other sources making a total of £99,006. From this the following charges had to be met: Payment to local authorities for running powers, &c., £25,893; repairs, &c., to property in Church Street, £266; loan charges, &c., £74,604; leaving a net deficit of £1,757. The previous year's working resulted in a surplus of £12,005. All the above amounts embody the figures for the motor-omnibus services. The number of passengers carried increased from 81,652,275 to 83,881,591, and the car-miles run from 6,238,336 to 6,377,694. The receipts per car-mile fell from 18.316d. to 17.966d.

Telegraph and Telephone Notes.

Australia.—"Beam" Radio-telegraphy.—It is officially announced from Melbourne that the "beam" wireless-telegraph station in Australia will commence testing operations in October, and general working soon afterwards at rates not exceeding 2s. per word.

Belgium.—New Radio Service.—It is announced that an official wireless-telegraph service will be opened shortly between Belgium and the Congo, and *vice-versa*.—*Reuter* (Brussels).

Brazil.—Telephone Extension.—According to *Commerce Reports*, the Minister of Transportation recently signed a contract with the Campanhia Telephonica Rio Grandense, authorising that company to extend its telephone lines to the borders of Uruguay and Argentina. Porto Alegre has 5,000 automatic telephones in use and Pelotas 2,000.

Germany.—Radio Telegraphy.—The German Telegraph Department has two wireless telegraph services in operation, one with Spain (Madrid and Barcelona) and one with Vienna (Austria) and Belgrade (Serbia). For communication with Spain the transmitting station at Nauen is used, having a power of 16.2 kW and working on a wave length of 4,000 metres; the two receivers are installed at Geltow. For the Vienna and Belgrade service the transmitting station is at Königswusterhausen, the power being 10 kW and the wave-length 5,200 metres, while for incoming messages there are two receivers at Zehlendorf. Some atmospheric disturbance has been experienced on the service to Spain, but that to Belgrade and Vienna is giving excellent results, as many as 1,000 telegrams per day in each direction being transmitted to and from the last-named city.

Portuguese East Africa.—Radio Telegraphy.—According to a communication from Mozambique, there has been constructed on the island of Bzaaruto a wireless-telegraph station working on a wave-length of 600 metres and with a range of 100 miles, which is open for public service and for navigation.—*Reuter* (Lisbon).

Telegraph Employés' Wages.—A Dispute.—The Indo-European Telegraph Company's employés on Soviet territory have, according to a Soviet report, declared a strike in view of the company's refusal to pay higher wages.

Radio Notes.

Australia.—GOVERNMENT INVESTIGATION.—In July last, the Premier (Mr. Bruce) had a long conference with the Postmaster-General (Mr. Gibson) with regard to requests for an alteration of the existing wave-lengths and alleged excessive charges for patent royalties and copyright. The wave-length question was being examined, and a definite pronouncement was to have been made by the Government before the end of last month. The patent royalty question, he said, was being taken up with the Government directors on the Amalgamated Wireless Board, and with regard to copyright charges, a conference was being convened by the Government, and a report would be presented to the Government for its consideration.

Poland.—RESTRICTIONS EASED.—All restrictions hitherto in force have been abolished, except that the authorities still reserve the right to withdraw or refuse permission to grant licences to foreigners living within the frontier. The procedure for obtaining licences has been made simpler; nevertheless, registration remains compulsory, and "piracy" will be dealt with by fines, or imprisonment.

South Africa.—LICENCE FEES.—The Radio Act, 1926, includes, among other things, a schedule of licence fees for transmitting and receiving sets, ranging from £1 for an experimenter to £6 5s. for a hotel, or other premises licensed for the sale of liquor. It is reported that the financial position of several broadcasting stations in the S.A. Union is not as satisfactory as might be desired.

According to the *Daily Mail's* Johannesburg correspondent, broadcasting is in jeopardy in South Africa. In the year just concluded a private broadcasting company in Johannesburg lost more than £4,000, and the Durban (Natal) municipal station nearly £9,000; the Capetown station was also run at a loss. A conference is being held to discuss nationalisation, or, alternatively, a Government subsidy.

Spain.—AMALGAMATION.—The Union Radio, which recently celebrated its first birthday, has taken over the control of the Cadiz station and the two stations in Seville, which is a step further towards the long-desired aim of a single broadcasting company in Spain, which will put an end to the existing conflict of interests, says *World Radio*. Radio-Castilla has applied for the necessary official permission to introduce various technical improvements, and while these are being carried out, it will be necessary for transmission to be temporarily suspended.

United States.—PATENT INFRINGEMENT.—The United States District Court for the Eastern District of Pennsylvania has found for the plaintiff in the case of the De Forest Radio Telephone and Telegraph Co. *v.* Westinghouse Electric and Manufacturing Co., a radio patent suit concerning alleged infringement of the plaintiff's patents on the so-called "feed-back" or "regenerative" circuit arrangement employed with a three-electrode vacuum valve. The question of priority as between the De Forest and the Armstrong patents was at issue, and the effect of conflicting decrees of the District Court for the Southern District of New York, affirmed by the Circuit Court of Appeals of the Second Circuit, and of the Court of Appeals of the District of Columbia was squarely raised, says the *Electrical World*. The two courts first named sustained the Armstrong claims, and the defendant maintained that the question was, therefore, *res adjudicata* and could not be reopened. The court in Pennsylvania refused to accept this view, holding that these decrees were interlocutory in nature and that the decision of the Court of Appeals of the District of Columbia must control, unless additional testimony carried conviction that that court was in error. After analysis of such testimony, the Pennsylvania court held that this was not the case, and declared that De Forest was the first and original inventor of the feed-back circuit and the oscillating audion, and that claims Nos. 1, 2, 3, 5, 8, 9, 12, 14, 15, 16, 17, and 18 of Armstrong patent No. 1,113,149 are invalid.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—October 20th. Victorian Government Railways. Rail motor equipment. (A.X. 3449.)*

October 5th. Postmaster-General's Department. Switchboard cords. (B.X. 2747.)*

October 12th. Automatic exchange equipment.

October 26th. Telephone plugs and sleeves. (B.X. 2799.)*

November 9th. Telephone transformers. (B.X. 2797.)*

SYDNEY.—September 20th. Municipal Council. H.p. d.c. apparatus for cable testing.

October 18th. Two 100-ton electrical overhead travelling cranes. (A.X. 3467.)*

November 1st. Boiler feed pumps for Bunnerong power station. (A.X. 3470.)*

Belgium.—September 16th. Municipal authorities of Schaerbeek. 1,250 5- and 10-amp. single-phase electricity meters. Particulars from Service de l'Electricité, Hotel Communal, Schaerbeek.

Chester.—September 13th. Electric wiring of Chester Castle. (August 27th.)

Croydon. — September 6th. Electricity Department. Two 50,000-lb. water-tube boilers and equipment. (July 30th.)

Dublin.—Department of Posts and Telegraphs. September 6th. Paper core twin cable (various sizes).

September 7th. Enamelled and cotton core cable (various sizes).

Edinburgh.—September 10th. H.M. Commissioners of Works. Electric wiring (in steel conduit) at Edinburgh Castle. Architect, H.M. Office of Works, 122, George Street, Edinburgh.

Grays. — September 6th. Grays Thurrock Electricity Department. One 250-kW rotary converter, with transformer, h. and l.p. switchgear, one 500-kW motor-converter, with h. and l.p. switchgear. (August 20th.)

Halifax.—September 18th. Housing Committee. Electrician's work (wiring) required in connection with the erection of 58 houses, Nursery Lane (Section No. 4, Ovenden Cross). Specification from Borough Engineer, Crossley Street, Halifax.

India.—September 10th. India Store Department. Switchgear and auxiliary plant in connection with the G.I.P. Railway electrification. Forms of tender (20s.) from the above.

September 10th. One 300-kW d.c. steam set, with boiler, condenser, cooling tower and auxiliaries, and switchboard, &c., complete for Peshawur Cantonment power station. (August 27th.)

Keighley.—September 10th. Board of Guardians. Supply of electrical goods. Particulars from Mr. S. Green, clerk to the Guardians, Oakworth Road, Keighley.

London.—LONDON COUNTY COUNCIL.—September 13th. Three water-tube boilers, with auxiliaries. (August 13th.)

September 6th. Electrical installation at the Hackney Institute. (August 20th.)

ST. MARYLEBONE.—September 13th. Works and Highways Department. Electric overhead runway for house refuse. Specifications from the Borough Engineer.

HOLBORN.—September 8th. Board of Guardians. Six months' supply of electrical fittings. Forms of tender from Mr. C. J. Cross, Clerk to the Guardians, 53, Clerkenwell Road, E.C.

BATTERSEA.—September 22nd. Electricity Department. E.h.p. and l.p. d.c. switchgear for 1,000-kW motor-generator, outgoing d.c. feeder switchgear, and works power switchboard. (See this issue.)

ISLINGTON.—September 18th. Board of Guardians. Electrical supplies for six months. Forms of tender from Mr. A. King, Clerk to the Guardians, St. John's Road, Holloway, N.

New Zealand.—CHRISTCHURCH.—October 19th. Christchurch Drainage Board. Three sets of electric centrifugal pumping plant. (A.X. 3215.)*

WELLINGTON.—September 28th. Public Works Department. Three electrically-driven low-lift pumps, with control apparatus, for the Taleri drainage. (A.X. 3274.)*

November 2nd. Electric generators and turbines. (B.X. 2622); indoor control gear and switchgear. (B.X. 2675); 110,000-V transformer for Waikaremoana power scheme. (B.X. 2744.)*

October 5th. One four-motor overhead travelling crane and runway. (A.X. 3517.)*

November 23rd. Lightning arresters and transformers. (B.X. 2792.)*

NEW PLYMOUTH.—October 16th. Harbour Board. One 30-cwt. portal electric jib crane, &c. (A.X. 3458.)*

AUCKLAND.—October 4th. Electric Power Board. Pole oil switches. (B.X. 2795.)*

October 11th. Ironclad switchgear and single-phase transformers. (B.X. 2793.)*

INVERCARGILL.—December 1st. Southland Electric Power Board. One 3,200-h.p. horizontal Francis turbine and one 2,350-kW generator. (B.X. 2822.)*

South Africa.—JOHANNESBURG.—September 18th. Town Council. 6,600-V, truck-type, ironclad switchgear. (B.X. 2767),* underwriters' wire. (B.X. 2766.)*

September 23rd. Switchboard type overload relays. (B.X. 2809.)*

CAPE TOWN.—September 15th. Municipal Council. Cables. B.X. 2802.)*

Stoke-on-Trent.—September 7th. Electricity Department. One 10,000-kW turbo-alternator and condensing plant. One natural-draught cooling tower. Ironclad l.p., 3-phase switchgear. (July 23rd.)

Tunbridge Wells.—September 11th. Electricity Committee. Two water-tube boilers, superheaters, economisers, mechanical stokers, forced- and induced-draught plant, steel stack, overhead coal bunkers, coal elevator and conveyor, and a truck tippler. (August 13th.)

Warrington.—September 6th. Electricity and Tramways Committee. 12 months' supply of earthenware conduits. (August 20th.)

Wigtownshire.—The Educational Authority invites tenders for an electrical installation in connection with the reconstruction of Douglas-Ewart High School, Newton Stewart. Schedules from Mr. Alex. Young, architect, 75, Victoria Street, Newton Stewart.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Bath.—
Installing electric light at Manvers Street Baptist Church.—H. L. Bush and Co.

Dublin.—City Commissioners. Accepted:—
New electric storage battery at Crooksling Sanatorium (£650, less £111 for the old battery).—Siemens-Schuckert, Ltd.
Wiring houses in two sections, at Croydon Park (£1,249 and £1,157).—Gleeson & O'Dea & Co.

Dundee. — When the Corporation Electricity Committee accepted tenders for cable and transformers, the Convener remarked on the change that had come over prices; they would remember that formerly the prices of foreign cables were hundreds of pounds cheaper than the British, but now the foreign cable prices had gone up while the British prices showed a tendency to decline. There was only a difference of £138 between the British and foreign offers, and it was agreed to accept the tender of the Standard Telephones and Cables, Ltd., at £2,524.

Accepted :—
Six transformers (£1,165).—Ferranti, Ltd.

Glasgow.—The Scottish Board of Health has approved of the acceptance by Glasgow Corporation of the offer of Callender's Cable and Construction Co., Ltd., for underground cable, &c., at Bellefield Sanatorium.

Health Committee. Recommended :—
Electric lighting work at Bellefield Sanatorium (£963).—James Laird and Co., in lieu of that of Haddow & Co. at £1,215.

Lamp Contracts.—Siemens & English Electric Lamp Co., Ltd., has received a six months' contract for gasfilled and vacuum lamps from the Southern Railway, and a twelve months' contract for gasfilled lamps from the General Post Office.

Leeds.—Watch Committee. Accepted:—
Electric lighting installation at firemen's dwellings (£193).—T. M. West.

Electricity Committee. Accepted :—
Cable.—£1,579, Enfield Cable Works, Ltd.; £717, W. T. Henley's Telegraph Works Co., Ltd.; £1,591, Macintosh Cable Co., Ltd.; and £898, Hackbridge Cable Co., Ltd.

Manchester.—Electricity Committee. Accepted:—
Cable.—Macintosh Cable Co., Ltd.; Standard Telephones & Cables, Ltd.; and Johnson & Phillips, Ltd.
Weldless steel spigot and faucet tubes.—Brownford Tube Co., Ltd.
One 500-kVA static transformer.—British Electric Transformer Co., Ltd.

Central Purchasing Committee. Accepted :—
Electric lamps.—Drake & Gorham and F. G. Ride & Co.

Tramways Committee. Accepted :—
Collier automatic points.—Forest City Electric Co., Ltd.
Copper trolley wire.—R. Johnson & Nephew, Ltd.
Cadmium copper trolley wire.—T. Bolton & Sons, Ltd.

Salford.—Electricity Committee. Recommended:—
Cable (£853).—W. T. Glover & Co., Ltd.

Sittingbourne and Milton.—Joint Hospital Board. Accepted :—
Electric lighting installation at the hospital :—
Oil engine and equipment (£1,102).—Campbell Gas Engine Co., Ltd.
Dynamo and booster, switchboard and connections (£445).—J. H. Holmes and Co.
Wiring, fittings, lamps, &c. (£821).—Brunswick Engineering Co., Ltd.
Accumulators (£545).—Alton Battery Co., Ltd.

Forthcoming Events.

National Radio Exhibition.—At Olympia, W. September 4th to 18th.
Universal Smoke Abatement Exhibition.—At Bingley Hall, Birmingham. September 6th to 18th.
Municipal Tramways Association.—At Liverpool. September 7th to 10th. Annual conference.

Notes.

The World Power Conference (Sectional Meeting) at Basle.—Our special correspondent at the World Power Conference, which opened on Tuesday last, telegraphs that 580 members are in attendance, representing 39 countries.

The Conference was opened by Dr. Tissot, and addresses were delivered by Mr. Chouard, representing the Swiss Government; Mr. Aemmer, representing the City of Basle; and Mr. D. N. Dunlop, chairman of the British National Committee.

Electricity in South Wales.—A Cardiff correspondent of *The Times Trade and Engineering Supplement* says that an outstanding feature in South Wales of recent years has been the steady development of the use of electrical energy, and emphasis is given to the progress made when it is realised that the newer collieries have been equipped for working by electricity generated, in some cases, many miles away, and carried by overhead cables over mountainous country. Obviously, colliery engineers must have been fully convinced of the economy and efficiency of electrical working before embarking on large expenditure for the installation of plant. In making comparisons, it must not be overlooked that steam power has been an old and well-tried friend of the colliery engineer, and that the coal for producing steam is cheaper at the pit head than anywhere else. In fact, small coal, containing a considerable percentage of slaty refuse, is a waste product of the mine, and if not consumed under pit boilers or put through a washing process, has to be carried away at considerable expense to the pit dumping grounds. The Powell Duffryn, Ocean, Tredegar, and other large colliery enterprises have their own central power generating stations, while many of the smaller collieries are using power purchased from the South Wales Electrical Power Distribution Company. The latest development is that one of the large new anthracite combinations is about to install new electrical plant to the value of from £140,000 to £150,000.

The Rating of Scottish Undertakings.—The Dundee Corporation Electricity Committee, at its last meeting, considered a communication from the Incorporated Municipal Electrical Association regarding an important question of valuation and rating which has arisen in connection with the Aberdeen electricity undertaking. It arose out of a judgment by Lord Skerrington to the effect that assessors were not entitled to allow any deduction in respect of revenue raised for interest and sinking fund on uncompleted or unproductive works. This judgment affects all trading departments which are assessed on what is known as the revenue principle. In all trading departments in large cities in Scotland, it was pointed out, it had long been desired to have the opportunity of testing the soundness of this judgment before a Bench of three judges. This point had now arisen in Aberdeen under peculiarly favourable circumstances, and it was suggested that the appeal should be supported, both on moral and financial grounds. The appeal was expected to cost not more than £200, and an appropriate contribution from Dundee would be £20. The Committee was of opinion that it would be well to test the case, and agreed to contribute the suggested sum.

Each to His Job.—*Electrical Merchandising* says that the proprietor of an electrical supply store in Jacksonville, Fla., who had been bothered more than usual by people asking him to cash cheques for them, put an end to the whole nuisance without much trouble. He hung a neat little sign in his store worded as follows :—

"We have made arrangements with the banks whereby we will cash no cheques and they will sell no electrical supplies."

Electrical Installation at New Soap Works.—With reference to the note under the above heading in our issue of August 13th, we are informed by Messrs. S. H. Heywood and Co., Ltd., that they were the main contractors for the supply and installation of the whole of the coal-handling plant, including the wagon tippler, and also the electrical equipment of the special ash hoist, the control gear of the latter being of this firm's own design and manufacture.

Tungstone Accumulator Tests.—We have received from the Tungstone Accumulator Co., Ltd., an illustrated booklet containing, in addition to particulars and prices of the company's products, reproductions of test certificates issued on July 30th, 1926, by the National Physical Laboratory. The company states that these tests constitute "a world's record in the very high percentages of amp. and watt-hour efficiency recorded for any battery." The tests were made as follows: A charged six-volt accumulator was discharged at five amperes till the voltage on closed circuit fell to 1.8 V per cell; it was then recharged at 5 A for the same period. After discharge at 5 A to 1.8 V per cell, it was recharged at 5 A for the same period, and finally discharged at 5 A to 1.8 V per cell. This programme gave the following results :—

1st discharge 57.5 Ah, 116.0 Wh
1st charge 57.5 Ah, 127.5 Wh } { Ah efficiency 96 per cent.
2nd discharge 55.0 Ah, 112 Wh } { Wh efficiency 88 per cent.
2nd charge 55.0 Ah, 124 Wh } { Ah efficiency 96 per cent.
3rd discharge 53.0 Ah, 107.0 Wh } { Wh efficiency 86 per cent.

The first discharge and first charge occupied 11¼ hours; the second cycle, 11 hours; and the third discharge 10.6 hours.

The efficiencies thus obtained are certainly remarkably high; but it should be borne in mind that the duration of charge and discharge diminishes with each cycle, and the following quotation from "Storage Batteries," by G. W. Vinal, Physicist, U.S.A. Bureau of Standards, is of interest in this connection (p. 306) :—

"The following method for determining the maximum ampere-hour efficiency was suggested to the author by J. L. Woodbridge. A fully-charged battery is discharged at some chosen current to a fixed cut-off voltage, careful measurement being made of the exact number of ampere-hours delivered. On the recharge the same number of ampere-hours are put back at the same current. A second discharge is then made to the same cut-off voltage as before. The efficiency of the battery is then calculated as the ratio of the ampere-hours delivered during the second discharge to the ampere-hours put in on the charge. After correcting for the slight increase in temperature as a result of the charge, the ampere-hour efficiency by this method has been found to be within the range 98 to 100 per cent. Such a measurement does not, however, represent the ordinary service conditions."

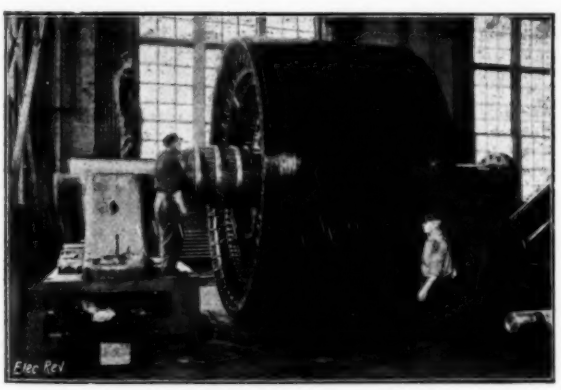
Fatalities. — Joseph Carter, employed by the British Thomson-Houston Co., Ltd., as an electrician, received a fatal electric shock on August 24th. The deceased was engaged upon the installation of 6,600-V switchgear at the Halifax Corporation electricity works in connection with the Halifax-Huddersfield linking-up scheme.

At the inquest on August 26th the verdict was "Accidental death from shock"; there was no evidence of how the accident occurred, nobody having seen it. Carter had been found dead on the floor near one of the e.h.p. cables. The door of an upper cubicle, which was in commission, and was usually locked, was open. It was locked by a coach key, and it appeared that it had been opened with a file handle. Officials of the department said that Carter had no right to be near the spot where he was found. The doors of the cubicles in commission were painted a distinctive colour. Apparently he had received a shock at 6,700 V. The Coroner (Mr. E. W. Norris) suggested that there ought to be a more secure way of fastening the cubicles at the works.

A painter named Francis Graham was killed owing to an electric shock while working on an overhead girder at the works of General Motors, Ltd., Hendon. At the inquest on August 26th it was stated that current was switched on while Graham was near some wires. He received a shock which, while perhaps it would not have killed him, caused him to fall and fracture his skull. The coroner attributed Graham's death to the negligence of an electrician.

Brynmor Edward John, aged 18, received a fatal electric shock at Messrs. Cory's collieries at Ogmore Vale, Glamorgan, on August 24th. At the inquest, held on August 27th, it was stated that a wire fence had been erected round the colliery power station and electrified at certain hours, owing to raids that had been made on the coal bunkers. The boy got inside the fence and, on seeing an official, ran away. He slipped and his hand came in contact with the wire. The voltage of the fence was 45 V. The doctors stated that the boy was not in normal health. A verdict of "Manslaughter" was returned against the person or persons responsible for the erection and electrification of the fence.

Special Right of Way for Movement of Apparatus.—So large was the armature for a 40,000-kVA frequency changer recently shipped from the New York works of the General Electric Co. of America that it was necessary to provide a special right of way over the Delaware and Hudson Railway to Albany. The armature, weighing 226,000 lb., is 13 ft. in diameter and 20 ft. long, while the maximum railway clearance is but 10 ft., so that it was impossible for a train to pass this apparatus on either side. Shipment of the apparatus was made from the works early on a Sunday morning; the tracks on both sides of the Delaware and Hudson Railway were clear

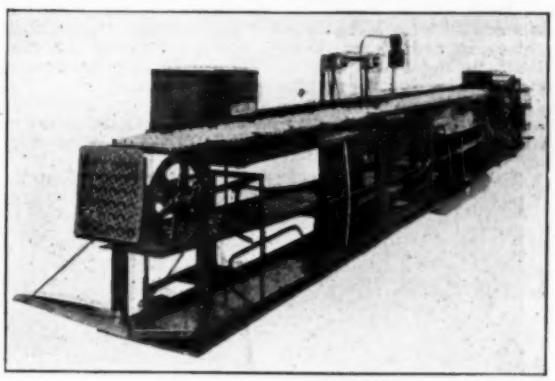


A 40,000-kVA Frequency-changer Armature.

of cars all the way from New York to Albany, and it was also necessary for the works to remove the windows from above the doors in the building in which the armature was constructed, and also to remove the gates of the yards before the apparatus could be delivered to the Delaware and Hudson tracks. On its arrival in Albany, the car was switched to a Hudson River dock, where it was unloaded by a wrecking derrick and taken to the N.Y. Edison Co. in New York City by boat. The derrick, the *Monarch*, is one of the two recently used by the Government in its effort to raise the sunken submarine S-51.

Large Hydro-Electric Plant in Germany. — What is claimed to be the largest turbine for hydro-electric station operation in Europe has lately been completed by the Voith Co., of Heidenheim, Germany, for the Kachlet plant on the River Danube, and is at present being displayed at the Water Utilisation Exhibition in Switzerland. The turbine has a propeller diameter of 15 ft., the weight of the rotating wheels being 22 tons. The machine is intended to work under a water head of from 9 ft. 10 in. to 29½ ft., and to develop a maximum of 9,500 h.p. When fully completed the Kachlet station will be equipped with nine turbo-generator sets of this capacity.

Sterilising Eggs Electrically.—A recent application of electric heating is for the sterilisation of eggs, and a report from the American Pacific Coast describes the success of the first machines electrically equipped for this purpose. The sterilising machines were manufactured by the Clairmont Sterilised Egg Corporation, San Francisco, and about ten machines have been installed on the Pacific Coast, some being in Petaluma and some in Hayward, California. Sterilisation is accomplished by passing the eggs through an oil bath at 235 deg. F., the oil fills the pores in the eggshell and prevents air from entering. It is said that tests have been made which indicate that eggs so treated will keep odourless and fresh for years. A recent installation was made for the Wilsey Bennett Co., of Petaluma. The machine has a capacity of 350,000 eggs per 10-hour day, although it can be regulated to almost any speed up to that point. The sterilising tank holds 45 gallons of oil, and is heat-insulated with a one-inch air space; the processing oil is circulated from a shallow pan near the floor to the sterilising tank and back again by means of an automobile gear pump. The eggs are automatically dipped for 3½ seconds, and heat control is maintained automatically. The machine is completely electric, using G.E.C. equipment; the driving motor is



Electric Egg-sterilising Plant.

rated at ½ horse-power, and the heat is supplied by eight 2½-kilowatt oil-immersed heaters of the helicoil sheath-wire type. The total connected load is 20 kilowatts. Prior to the use of electric heat, steam, kerosene, natural and artificial gas, or gasoline were used as fuels. It was found that, although the fuel cost remained about the same as with gas, close heat regulation, a very essential factor, was obtained only with electricity. Further advantages of electric heat were found to be cleanliness and a saving in labour, two men only being needed with the electrical process, while a third was formerly used to regulate the heat. The electrical method was adopted only after all other forms of heat had been tried.

Appointments Vacant.—Director of the Electrical Department, for the Government of the Bahamas (£800); electrical engineer in the L.C.C. Tramways Department (£1,200+); temporary draughtsman and constructional assistant for the Maidstone Electricity Department; electrical engineer (£569) for the Portobello generating station; charge engineer for the Lancashire Electric Power Co. (See our advertisement pages to-day.)

How London Travels.—The growth of passenger traffic and change in the method of travel in Greater London since 1913 is disclosed in a remarkable way in the following *Daily Telegraph* tables. In 1913 the figures were:—

	Passengers carried.	Per cent. of total.	Rides per capita.
Tramways ...	812,000,000	... 36	... 110
Omnibuses ...	736,000,000	... 32	... 100
Railways ...	725,000,000	... 32	... 98

By 1925 the total volume of traffic had increased by 63 per cent., but the tramway passengers increased by only 21 per cent. The omnibus passengers increased by the phenomenal figure of 127 per cent., whilst the railway passengers increased by 45 per cent. The result has been that the tramways have fallen to the bottom of the table, whilst the omnibuses have risen to the top, the railways meanwhile advancing to the second place, as hereunder:—

	Passengers carried.	Per cent. of total.	Rides per capita.
Omnibuses ...	1,671,000,000	... 45	... 218
Railways ...	1,049,000,000	... 28	... 137
Tramways ...	979,000,000	... 27	... 128

Manual of Electrical Testing.—An interesting publication by Messrs. Wagner Electric Supplies, Ltd., should prove useful to installation engineers and others dealing with the maintenance of electrical equipment. It contains detailed information concerning some 30 practical tests for various electrical installations and equipment. Motor testing is dealt with fully, and the test connections are well illustrated. Considerable attention is also given to transformer testing. The publication, Bulletin 138, "Manual of Electrical Testing," can be obtained by interested engineers on application to the above-mentioned firm, the request to be made on the applicant's usual business notepaper, at its London address, 66, Victoria Street, S.W.1.

Institution Notes.

Institution of Electrical Engineers.—STUDENTS' SECTION.—*Summer Meeting.*—The Students' Section held its summer meeting this year in Belgium and Luxemburg. A party of 31 left London on July 31st for Brussels; four days were spent there, and visits made to various engineering works. The Sunday morning was free, the afternoon being spent in an auto-car drive to the battlefield of Waterloo. On the Monday morning a short lecture was given by Mr. A. Pescatore, M.I.E.E., at the offices of the Bureau d'Etudes Industrielles, on the position of the electrical industry in Belgium at the present time.

The works visited from Brussels were those of Ateliers de Constructions Electriques de Charleroi, of which only a small portion was seen, namely, the power and telephone cable and the heavy machinery shops.

At Ghent the morning was spent at the Anciens Ateliers van den Kerchove, makers of "Uniflow" steam engines, turbines and Diesel engines. Part of the afternoon was spent in sight-seeing, and the remainder at the power station Centrales Electriques des Flandres, which is working at a pressure of 800 lb./sq. in. and has a high overall efficiency.

On the Wednesday the party went to Antwerp by auto-car *via* Malines, where the Cathedral was seen and the works of the Bell Telephone Manufacturing Co. were visited at Antwerp.

I.E.E. Students in Luxemburg.

On the fifth morning the party left Brussels for Luxemburg, the journey being broken at Liege, where three visits were made; the Union des Centrales Electriques is very interesting, as there does not seem to be a similar concern in England. All large works in the neighbourhood of Liege which generate their own electric power are interconnected, and by means of diagrams and similar devices the operator at the Union des Centrales Electriques is able to see if any works at any instant is supplying power to or receiving power from the system. Luxemburg was reached late Thursday evening.

The whole of Friday was spent at the works of the Aciéries Réunies de Burbach-Eich-Dudelange at Esch. This is one of the largest Continental steelworks, the output exceeding two million tons per year. Here the whole process of making steel was seen, the A.R.B.E.D. having its own iron ore mines.

The party was entertained at luncheon by the firm, and was welcomed by Mr. A. Kipgen, one of the directors, who arranged for a photograph to be taken of the party (reproduced herewith).

Saturday morning was spent in Luxemburg; the offices of the A.R.B.E.D. were thrown open to the party for inspection, and several members availed themselves of the opportunity. On Saturday afternoon the party returned to Brussels. A farewell dinner was held in the evening, Mr. Pescatore and several other gentlemen being guests of the evening, at the conclusion of which a presentation was made to the hon. secretary by the members of the party. London was reached on the Monday evening after a most enjoyable week.

Municipal Tramways Association. — The annual conference of the above Association is to be held at Liverpool from September 7th to 10th inclusive. The members will be received on the Tuesday evening at the Adelphi Hotel by Mr. Percy Priestly (President) and Mrs. Priestly, and on the following morning a civic welcome will be given by the Rt. Hon. the Lord Mayor of Liverpool, Councillor F. C. Bowring, J.P. The programme, which provides for a number of social functions and excursions, includes the reading of the following papers: "Public Policy in Relation to Tramways and Motor-'Buses," by Councillor Major J. Fitzgerald Jones, M.C. (Salford); "Road Passenger Transport," by Mr. Alfred Baker (Birmingham); and "Motor-Omnibus Competition in Glasgow," by Bailie R. Laing (Glasgow). The annual dinner will be held at the Adelphi Hotel on Wednesday evening at 7.30 to 7.45 p.m.

Institution of Fuel Economy Engineers.—The Rt. Hon. Sir Alfred Mond, Bart., P.C., M.P., has accepted an invitation to become the first President of the Institution of Fuel Economy Engineers. The first meeting of the session will be held on Friday, September 24th, at 6 p.m., at the Royal Society of Arts, St. John's Street, London, when Dr. A. E. Dunstan will read a paper on the subject of "Liquid Fuels," including the less known fuels upon which research is now being carried out throughout the world.

Institution of Mining Engineers.—It is announced that the summer meeting of the above Institution, which was originally fixed to be held at Newcastle-upon-Tyne in June last and postponed, is now definitely cancelled owing to the continued stoppage in the coal industry.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. ALAN WILLIAMS, M.I.E.E., has been appointed by the Vickers Boiler Co., Ltd., sales representative for the South of England in connection with industrial boiler installations and export business.

Mr. WILLIAM MAKINSON, who has left the Sterling Telephone and Electric Co., Ltd., of Dagenham, to become assistant manager of the Benjamin Electric, Ltd., of Tottenham, has been presented with a gold watch by the works manager, Mr. C. E. Hunter, and the staff.

M. HENRI CAHEN, president of the Syndicat Professionnel des Producteurs et Distributeurs d'Energie Electrique, of Paris, has been promoted to be Commander of the French Legion of Honour.

The *Industrial Australian and Mining Standard* reports that Mr. G. SWINBURNE has resigned from the Victorian Electricity Commission owing to pressure of work. His place is taken by Mr. F. W. CLEMENTS, general manager of the Melbourne Electric Supply Co. The other Commissioners are Sir John Monash (chairman), Sir R. Gibson, and Sir T. Lyle.

Obituary.—MR. R. D. TATA.—The death occurred last week of Mr. Ratanji Dadabhai Tata, for many years a director of Tata & Sons, Bombay, and associated companies, including three hydro-electric concerns.

Will.—The late DR. JOHN BELL SIMPSON, formerly chairman of the Newcastle and District Electric Lighting Co., Ltd., and Waste Heat and Gas Electrical Generating Stations, Ltd., and a director of other concerns, left £812,170 gross and £761,825 net personalty.

New Companies Registered.

B. Morris (Electrical Radio), Ltd. (215,790).—Private company. Registered August 21st. Capital, £500 in £1 shares. Objects:—To carry on the business of electrical engineers, gas and electric lighting contractors, dealers in and agents for gas and electrical fittings, and all articles for the gas and electrical trades, and all devices and appliances whereby sound is recorded and transmitted, including radio, &c. The subscribers (each with one share) are:—W. L. Oliver, 50, Doughty Street, W.C.1, accountant; Annie M. Ashburner, 7, Euston Street, N.W.1, clerk. The first directors are not named. Qualification, 5 shares. Remuneration as fixed by the company. Secretary: M. J. Wilson. Registered office: 50, Doughty Street, W.C.1.

Eureka Electric and Wireless Maintenance Guarantee Co., Ltd. (215,866).—Private company. Registered August 26th. Capital, £500 in £1 shares. Objects: To acquire the business of electrical and radio manufacturers, &c., carried on by Wardell & Co., at Raleigh Road, Richmond. The permanent directors are:—S. A. Wardell, 98, Kew Road, Richmond, electrical engineer (managing director); W. Burningham, 98, Kew Road, Richmond, printer. Qualification, £100. Remuneration of managing director, £400 per annum, and 2½ per cent. of the net profits when a cumulative preferential dividend of 10 per cent. is paid; remuneration of directors, £100 per annum divided between them. Registered office: 108, Sinclair Road, West Kensington, W.14.

Wholesale Electric Supply Stores, Ltd. (215,818).—Private company. Registered August 23rd. Capital, £2,000 in £1 shares. Objects: To acquire the business of a manufacturer of and dealer in electrical sundries carried on by W. H. Osborn at 38, Gloucester Road, Brighton, as the "Brighton Electric Supply Stores." The permanent directors are:—W. H. Osborn, East Lodge, 37, East Street, Brighton, electrical engineer; Mrs. F. B. Osborn, same address. Qualification, £25. Solicitors: J. K. Nye & Donne, 58, Ship Street, Brighton.

Fibrok Products (1926), Ltd. (215,809).—Private company. Registered August 23rd. Nominal capital, £8,100 in 10s. shares. Objects: To adopt an agreement with Fibrok Products, Ltd., and W. J. Ling, the liquidator thereof, and to carry on the business of manufacturers, importers, exporters, brokers and factors of and dealers in rubber, rubber latex and rubber goods of all kinds, ebonite, "Stabilite" compounds for electrical and other requirements, &c. The subscribers (each with one share) are:—C. E. Haskett-Smith, 17, Gracechurch Street, E.C.3, underwriter; A. W. L. Wilson, 4, Copthall Court, E.C., stockbroker. The first directors are Sir Edward Penton, K.B.E., C. Haskett-Smith, and W. L. Wilson. Solicitors: Woodcock, Ryland and Parker, 15, Bloomsbury Square, W.C. The registered office is 10, Fenchurch Avenue, E.C.

Express Cable Engineering Co., Ltd. (215,742).—Private company. Registered August 19th. Capital, £300 in £1 shares. Objects: To carry on the business of engineers, manufacturers of radio apparatus, &c. The subscribers (each with one share) are:—G. H. Walpole, 37, Montpelier Street, Brighton, chartered secretary; A. C. Walpole, "The Sportsman," Mogador, Tadworth, Kingswood, Surrey, inn proprietor; W. Bentley, 35, Stockdale, Aylesbury, Bucks., engineer. G. H. Walpole signs as director. Qualification, 1 share. Remuneration, £26 each per annum.

Dorset and Devon Electricity Supply, Ltd. (215,793).—Public company. Registered August 21st. Capital, £10,000 in 9,500 non-cumulative preference shares of £1 and 10,000 ordinary shares of 1s. The net profits in each year are to be applied first in paying a dividend of 10 per cent. to the holders of the preference shares. The remaining surplus (90 per cent.) is to be applied to dividend to the ordinary shareholders. In a winding up the assets available for distribution are to be applied in paying £1 per share to the preference shareholders and the balance is to be distributed equally amongst the holders of the ordinary shares. Objects: To establish and develop electric light and gas undertakings, to carry on the business of electrical contractors, engineers, &c. Minimum cash subscription, 100 shares. The directors are:—L. J. Waring, 3, Prideaux Road, Stockwell, S.W.9; R. G. Harley, 45, Stamford Street, S.E.1, leather preservative manufacturer; J. Brigden, 69, Ferntower Road, Highbury, N.5, engineer. Qualification, £25. Remuneration as fixed by the board. Secretary (*pro. tem.*): L. J. Waring.

Castellina Co. (1926), Ltd. (215,792).—Private company. Registered August 21st. Capital, £1,500 in £1 shares. Objects: To carry on the business of dealers in and manufacturers of alabaster figures and bowls, electrical fittings, radio apparatus, &c. The life directors are:—G. W. Johnson, 80, Berkeley Crescent, New Barnet, electrical engineer; R. M. Johnson, 168, Northview Road, Hornsey, N.8, electrical engineer. Qualification, 1 share. Registered office: 58, Great Marlborough Street, W.1.

Official Returns of Electrical Companies.

Barlow & Redruth, Ltd.—Mortgage dated July 29th, 1926, to secure £127 5s. 9d. charged on a debt of £140 owing to the compnay. Holder: R. L. Stanners, Evesham Street, Redditch.

Satisfaction in full on August 12th of mortgage dated July 29th, 1926, securing £127 5s. 9d.

Debenture dated August 12th, 1926, to secure £200, constituting a floating charge on the company's undertaking and property, present and future, including uncalled capital and a fixed charge on the freehold, copyhold and leasehold property of the company. Holder: R. I. Stanners, Evesham Street, Redditch.

L. H. Shedden, 77, Darlington Street, Wolverhampton, was appointed receiver on August 13th under powers contained in debenture dated August 12th, 1926

Aurolite Electrical Supplies, Ltd.—Debenture dated July 27th, 1926, to secure £100, charged on the company's property, present and future, including uncalled capital. Holder: Col. H. B. Hans Hamilton, J.P., 3, Cranley Gardens, South Kensington, S.W.7.

Somerville Barnard Construction Co., Ltd.—Mortgage on a contract for the purchase and development of certain portions of the Moor Park Estate, and the company's undertaking and property, present and future, including uncalled capital, dated August 11th, 1926, to secure all moneys due or to become due from the company to the National Bank, Ltd.

Crompton & Co., Ltd. (129,649).—Capital, £500,000 in £1 shares (340,000 ordinary and 160,000 preference). Return dated July 15th, 1926. 326,769 ordinary and 140,725 preference shares taken up. £307,753 paid, being £1 share on 250,007 ordinary and 6,965 preference, 7s. 6d. per share on 133,760 preference, and £621 on 2,240 shares forfeited. £160,362 considered as paid, being £1 per share on 76,762 ordinary and 12s. 6d. per share on 133,700 preference shares. Mortgages and charges, £99,000.

South London Electric Supply Corporation, Ltd. (50,392C).—Capital, £310,000 in £1 shares (50,000 preference and 260,000 ordinary). Return dated April 13th, 1926. 30,000 preference and 260,000 ordinary shares taken up. £290,000 paid. Mortgages and charges, £130,000.

Eastern and South African Telegraph Co., Ltd. (13,306).—Capital, £600,000 in £10 shares. Return dated June 24th, 1926. All shares taken up. £600,000 paid. Mortgages and charges, nil.

Gorseinon Electric Light Co., Ltd. (39,944).—Capital, £60,000 in £1 shares. Return dated August 3rd, 1926. 31,574 shares taken up. £31,582 paid, including £8 paid on 10 shares forfeited. £2 remains in arrears. Mortgages and charges, nil.

Hewittic Electric Co., Ltd.—Debenture dated August 3rd, 1926, to secure £20,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Hackbridge Electric Construction, Co., Ltd., Hersham, Walton-on-Thames.

Mackay (Westcliff-on-Sea), Ltd.—Debenture dated May 5th, 1926, to secure £2,335, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. M. Mackay, 7, King's Road, Westcliff-on-Sea. (Registered August 17th, by permission of the Court.)

Electrical and Allied Instrument Manufacturing Co., Ltd.—Debenture dated July 28th, 1926, to secure £416 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: P. E. Jones, 330, High Road, Leytonstone.

Scarborough South Cliff Tramway Co., Ltd.—Satisfaction to the extent of £400 on June 22nd, 1926, of debentures dated December 20th, 1883, securing £1,600.

Welco Patents, Ltd.—E. Greenhill, of 7, Newhall Street, Birmingham, was appointed receiver on August 6th, 1926, under powers contained in debentures dated August 29th, 1924, and May 28th, 1925.

Sunderland District Transport Co., Ltd. (formerly Sunderland District Electric Tramways, Ltd.) (79,054).—Capital, £151,012 in 4,505 non-cumulative 6 per cent. preference shares of £1 each, 95,495 non-cumulative 12 per cent. preference shares of 10s. each, 95,010 ordinary shares of £1 each, and 74,990 ordinary shares of 1s. each. Return dated June 15th, 1926. 95,495 12 per cent. preference and 74,990 1s. ordinary shares taken up. £51,497 paid. Mortgages and charges, £213,315.

Electric and General Investment Co., Ltd. (31,506).—Capital, £201,500 in 19,900 preference and 20,000 ordinary shares of £5 each, and 40,000 deferred shares of 1s. each. Return dated July 23rd, 1926. All shares taken up. £121,500 paid, being £5 per share on the preference, £1 per share on the ordinary, and 1s. per share on the deferred. Mortgages and charges, £8,457.

Calcutta Tramways Co., Ltd. (14,764).—Capital, £1,400,000 in 700,000 ordinary and 700,000 preference shares of £1 each. Return dated July 13th, 1926. 700,000 ordinary and 250,000 preference shares taken up. £764,900 paid, being 8s. per share on 22,000 ordinary, 10s. on 40,000 ordinary, 14s. on 110,000 ordinary, £1 on 409,100 ordinary, and £1 on 250,000 preference shares. £185,100 considered as paid, being £1 per share on 118,900 ordinary, 12s. on 22,000 ordinary, 10s. on 40,000 ordinary, and 6s. on 110,000 ordinary shares. Mortgages and charges, £350,000 4½ per cent. first debenture stock and £250,000 7 per cent. second (registered) debentures.

Unique Wireless Co., Ltd.—Debenture dated July 16th, 1926, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. B. Ferguson, 5, Catherine Road, Surbiton, Surrey.

Bideford and District Electric Supply Co., Ltd. (181,201).—Capital, £50,000 in 20,000 preference and 30,000 ordinary shares of £1 each. Return dated June 4th, 1926. 11,437 preference and 14,864 ordinary shares taken up. £1 per share called up on 7,500 preference and 12,004 ordinary and 15s. per share on 3,937 preference and 2,860 ordinary. Return says: "Mortgages and charges, nil"; but separate document shows £20,000 debentures issued May 21st, 1926 (part of £25,000 authorised April 16th, 1926).

Whitehall Electric Investments, Ltd. (180,780).—Capital, £7,500,000 in 5,000,000 ordinary and 2,500,000 preference shares of £1 each. Return dated July 1st, 1926. All shares taken up. £2,500,007 paid on 7 ordinary and 2,500,000 preference shares. £4,999,993 considered as paid on 4,999,993 ordinary shares. Mortgages and charges, £3,428,072.

English Electric Co., Ltd. (152,250).—Capital, £5,000,000 in 1,500,000 preference and 3,500,000 ordinary shares of £1 each. Return dated May 5th, 1926. 983,565 preference and 1,664,023 ordinary shares taken up. £315,673 paid. £2,331,915 considered as paid. Mortgages and charges, £2,692,671.

Greenwood & Batley, Ltd. (27,098).—Capital, £600,000 in £1 shares (140,000 preference, 354,585 ordinary and 105,415 unclassified). Return dated July 28th, 1926. 110,660 preference and 354,585 ordinary shares taken up. £201,312 paid, being £1 per share on 69,340 preference and 121,340 ordinary, 6s. per share on 14,660 preference, and 10s. per share on 12,520 ordinary, leaving £26 in arrears. £247,515 considered as paid on remainder. Mortgages and charges, £100,000.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

German Loan in New York.—According to New York reports, negotiations are in course between several leading German electrical firms and the New York financial house Dillon, Read & Co., with a view to issuing a loan of $30,000,000. The object of the loan is to pave the way for the establishment of a German Electrical Trust, on lines similar to those of the German Steel Trust. Part of the loan will be issued in Germany. The principal firm interested in the scheme is the Siemens concern.—*Financial News.*

Cia. de Electricidad de la Provincia de Buenos Aires, Ltd.—The *Financial Times* states that the gross receipts for the past year were £444,962, an increase of £38,868, and the net earnings increased from £147,947 to £168,500, after allowing £25,000 for depreciation. After meeting all charges and adding a balance brought forward, there remains £99,190. The full 8 per cent. dividends are to be paid on the non-cumulative pre-preference and preference shares.

Edison Swan Electric Co., Ltd.—It was reported last week that an offer had been made by a firm of chartered accountants, acting for clients, to purchase the whole of the ordinary shares at the price of 13s. each. The board advises the acceptance of the offer. The value of the ordinary shares was reduced from £1 to 4s. in 1923, when there was a capital reconstruction. A dividend of 10 per cent. was paid in respect of the year ended June 30th, 1925.

Shawinigan Water and Power Co.—The directors have authorised the issue of $2,500,000 of common stock, at $150 per $100 share, to existing shareholders in the proportion of one to ten. The new stock will rank for the December quarter dividend. A dividend of $2 per common share has been declared in respect of the quarter ending September 30th.

Westinghouse Electric and Manufacturing Co.—Last week an issue of $30,000,000 of 5 per cent., 1946 debentures, at 99 per cent. was made in New York, on behalf of this company. The purpose of the issue is the redemption of the outstanding 7 per cent. gold bonds (due 1931) at 104½ per cent. on November 1st next.

Canadian General Electric Co.—A dividend of 1¾ per cent. has been declared on the preference stock in respect of the quarter ending September 30th.

Davis & Timmins, Ltd.—An interim dividend at the rate of 6 per cent. per annum, free of tax, has been declared on the ordinary shares, as in 1925.

Pinchin & Johnson, Ltd.—The directors have decided to again pay an interim dividend of 10 per cent. on the ordinary shares, as the business has continued satisfactorily in spite of industrial difficulties.

Stock Exchange Notice.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Hellenic Electric Railways Co., Ltd.—£200,000 7 per cent. 20-year bonds, Series "A." £200,000 7 per cent. 20-year convertible bonds, Series "B."

Pennsylvania Water and Power Co.—A dividend of $2 per common share has been declared in respect of the quarter ending September 30th.

Chas. Clifford & Son, Ltd.—An interim dividend at the rate of 10 per cent. per annum, free of tax, has been declared on the ordinary shares.

Stocks and Shares.

Monday Evening.

The tendency of markets throughout the Stock Exchange is generally firm, though towards the end of last week there developed a little apprehension lest money rates should become stiffer in the early autumn. Business is beginning to revive, the return of holiday-makers serving to quicken interest in Stock Exchange securities, though the influence of August continues to be very marked. The feature amongst the groups with which we deal is the steady manner in which the prices of shares in manufacturing companies advance, while, spectacularly, the movements in Brazilian Tractions and their particular satellites are the main features of interest.

The reason for the strength of Brazilian Tractions is still difficult to define. Various disclaimers have been recently made in regard to the rumours that have been in circulation for the last few months, but, in spite of the denials, few shares come in, except those which are offered by profit-takers, most of whom are doing exceedingly well. The inside circles persistently talk the shares better. The price has risen 2 points this week to 122, and has touched 124½. Barcelona Tractions have gone up 3 to 40, and Sidros, in which there was a sharp reaction at one time, had no difficulty in recovering to 13. The strength of Mexico Tramways has ebbed, the price going back to 18. Mexican Light and Power stocks are rather better, the preferred shares gaining a couple of dollars. Shawinigan Water has risen several points to 227½; Montreal Light and Power is 3 up at 255. There has been a further demand for British Columbia Electric Railway stocks; the deferred is 3 up at 140; the preferred at 111½ shows a gain of a point.

The rises shown by manufacturing companies include Babcock & Wilcox, Edisons, Callenders, General Electrics, Siemens, Johnson & Phillips and Henleys. The last-named are ½ better at 4 1/16th; Callenders rose 1/16th to 3 5/16ths. The Stock Exchange market is mildly curious to see whether the price of Callenders will catch up, as it is expected to do, that of British Insulated ordinary. The whole of this group is very firm; there are no shares about, but at the same time every day brings a steady pressure to buy. Vague statements are made to the effect that the trade is prospering and that good profits are being made, with abundance of work in hand.

Edisons rose to 12s. 9d., on the offer to buy the shares at 13s. Last week they stood at 11s., and the proposed purchase sets the seal upon a rumour that has been current for, at any rate six months, if not longer, as readers of this column can testify. Babcocks are a good market, changing hands freely in the vicinity of 52s. There has been a little buying of some of the better class Vickers issues, and the 5½ per cent. debenture strengthened to 92½.

Globe Telegraph and Trust ordinary strengthened to 19½; Anglo-American Telegraph preferred lost ½ at 104. These are the only two changes that have occurred in the list of telegraphs and telephones. The market is languid and rather uninteresting, whatever animation the public are displaying in these issues being centred around shares in the manufacturing companies. Marconis and other wireless issues have "played passenger" during the past, passive, week.

In the Home Railway market, Underground Electric ordinary shares have weakened a trifle, going back to 3¾. The Stock Exchange has been talking for so long a time of an immediate collapse of the coal crisis that the cry has become blunted of its usefulness, and no one is paying much heed to it. The general opinion seems to be that, as the men are drifting back by slow degrees to the mines, this movement may in itself bring about the conclusion to the whole matter, while others in the House think that an agreement will be reached through the cherished policy of the Englishman, namely, a compromise, perhaps in the direction of hours of labour. British Electric Tractions spurted strongly, the price gaining 5½ points at 140.

A certain number of preference shares in the electrical industry are now available for investment. Whitehall preference can be bought at 20s. 7½d., to pay 7½ per cent. on the money; Midland Counties 6 per cent. preference at 21s. 6d. x.d. yield rather over 5½ per cent. The dividends in both these cases are well covered. English Electric 6 per cent. preference at 18s. 3d. pay £6 11s. 6d. per cent., though the margin in their case, on the figures of the last-published accounts, is not liberal. British Thomson-Houston sevens can be bought at 23s. 6d., with June and December dividends, to pay a shade under 6 per cent. on the money, the security in their case being substantial, and South Metropolitan Electric 7 per cent. first preference at 26s. x.d. have so wide a margin of safety behind them that people are content to invest in them up to a yield of no more than 5½ per cent.

The rubber share market is holding its own, without varying greatly from day to day. The prophets profess to look for an improvement in the statistical position as likely to take place in the later autumn, in anticipation of which a fair amount of quiet speculative investment is taking place. The difficulty is, as already explained, to obtain any reasonable supply of shares in the good-class companies.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Aug. 30 1926.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	1¼	1¼	54/6	—	5 2 9
Brompton Ordinary	1	10	10	8½xd	—	*6 8 0
Charing Cross Ordinary	1	15	15	44/6	—	6 14 10
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	49/6xd	—	6 1 3
do. do. 6% Pref.	1	6	6	22/6xd	+6d.	5 6 8
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15	15	59/6	—	5 0 10
do. do. 6% Pref.	1	6	6	23/-	+6d.	5 4 4
Edmundson's Ordinary	1	7	8	24/3	—	6 12 0
do. 7% Pref.	1	6	7	22/6	—	6 4 5
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	15	15	13½	—	5 11 1
Lancs. Light and Power	1	7½	7½	24/-	—	6 5 0
London Electric	1	10	10	32/-xd	—	6 5 0
do. do. 6% Pref.	5	6	6	5¾	—	5 11 7
Metropolitan	1	11	11	37/-	—	5 18 11
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	20/6	—	5 17 1
Newcastle-on-Tyne Ordinary	1	7	7	22/-	+9d.	6 7 3
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16¼	—	5 8 6
South London	1	15	15	2¾	—	5 14 8
South Metropolitan Pref.	1	7	7	1½xd	−9d.	5 12 0
Urban Ordinary	1	4	7	1¼	—	6 4 5
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	42/6	—	7 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/3	—	7 8 0
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

Home Rails.

Central London Ord. Assented	Stock	4	4	69xd	—	5 15 11
Metropolitan	,,	5	5	64	—	7 16 4
do. District	,,	3½	3½	52	—	6 14 7
Underground Electric Ordinary	10	Nil	Nil	3¾	−¼	Nil
do. do. "A"	1/-	Nil	Nil	11/6	—	Nil
do. do. Income	Bonds	6	6	103	—	*5 16 6

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	104	−½	5 15 5
do. Def.	,,	1½	1½	24⅞	—	6 1 3
Automatic Telephone	1	3	6	2⅞	—	4 2 1
Chili Telephone	5	5	6	7¾	—	*4 4 3
Cuba Sub. Ord.	10	5	5	6¾	—	7 5 6
Eastern Extension	10	10	10	19½	—	*5 4 8
Eastern Tel. Ord.	Stock	10	10	189½	—	*5 5 0
Globe Tel. and T. Ord.	10	10	10	19½	+½	*5 3 11
do. do. Pref.	10	6	6	11¼	—	5 7 10
Great Northern Tel.	10	22	20	27½	—	7 5 6
Indo-European	25	9½	10	46½	—	*5 7 6
Marconi	1	10	Nil	15/-	—	... ...
Marconi-Marine	1	10	7½	20/-	—	7 10 0
Oriental Telephone Ord.	1	12	12	46/3	—	*5 3 10
United R. Plate Tel.	5	8	8	8⅞	—	*4 17 9
Western Telegraph	10	10	10	18¾	—	*5 7 8

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	2½	−⅛	9 8 10
do. do. 2nd Pref.	5	6	6	2½	—	11 3 2
do. do. 5% Deb.	Stock	5	5	75	—	6 13 4
British Electric Traction Ord.	,,	7	8	140	+6½	5 14 4
do. do. 6% Pref.	,,	6	6	110	—	5 9 1
Brazil Traction	100	4	5	122	+2	4 2 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	86½	—	5 15 7
do. do. Preferred	,,	96/-	126/9	110½	—	*5 15 9
do. do. Deferred	,,	129/5	8	140	+3	*5 15 4
do. do. Deb.	,,	4¼	4¼	79	—	5 7 7
London & Sub. Trac. 5% Pref.	1	2½	Nil	5/-	—	Nil
London United Tram. Deb.	Stock	4	4	47	—	8 10 2
Mexico Trams, 5% Bonds	—	5	5	71½	—	6 19 10
Mexican Light Common	100	Nil	Nil	31½	—	Nil
do. Pref.	100	Nil	Nil	85½	+2	Nil
do. 1st Bonds	—	5	5	68½	—	6 7 6
Yorkshire (West Riding)	1	5	—	11/6	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	12	13	2⅜	+1/3	*4 19 1
British Aluminium Ord.	1	5	10	48/9	+2/-	4 2 1
British Elec. Transformer Pref.	1	Nil	7	18/3xd	—	7 13 5
British Insulated Ord.	1	15	15	3⅜	—	4 8 11
Brush Ord.	1	10	10	25/9	—	7 15 4
Callenders	1	15	15	3 5/16	+1/16	4 11 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	13/3	—	... ...
Edison-Swan	4/-	10	10	12/9	+1/9	3 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 3
Electric Construction	1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1¼	—	6 6 4
English Electric	1	5	Nil	16/3	+6d.	... ...
do. do. Pref.	1	6	6	18/-	—	6 13 4
Gen. Elec. Pref.	1	6½	6½	23/-	+6d.	5 13 1
do. Ord.	1	5	7½	31/-	+9d.	4 16 9
Henley	1	16	20	4 1/8	+⅛	4 18 9
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	23/-	—	*4 6 11
Johnson & Phillips	1	10	17½	66/3	+3/3	5 5 8
Met.-Vickers Ord.	1	8	8	25/9	—	6 4 9
do. Pref.	2	8	8	2⅞	—	6 14 9
Siemens Ord.	1	7½	7½	31/3	+1/3	4 16 0
Telegraph Construction	12	20	10	28½	—	*4 2 6

*Dividends paid free of Income Tax.

The British Association.—IV.

The Oxford Meeting.

Accidents in Industry.

By A. STEPHENSON (of the National Institute of Industrial Psychology).

(Abstract of a paper read before Section J—Psychology.)

In this paper the author discussed methods which had been adopted in the investigation of accident-frequency in industry, and compared the present results with some of those previously obtained.

The first attempts made to prevent accidents, he said, consisted of the installation of mechanical safeguards. To-day it was estimated that about one-third of industrial accidents were attributable to machinery, and not more than one-third of these machinery accidents were due to the absence of guards. This left 90 per cent. of present-day accidents to be accounted for as failures on the part of the human subject. Let them not, however, belittle the success of mechanical safeguards, though they must treat the possibility of all machinery being fool-proof solely as a very desirable ideal to be attained in the far distant industrial millennium. The United States Federal Board for Vocational Education related in Bulletin No. 47 that one of the big steel corporations reduced its accidents by 80 per cent. in about twelve years on a personnel of 10,000. Another, with 2,500 employés, had in three years reduced its lost-time accidents from 769 to 124, a reduction of 84 per cent., with a decline in the percentage incidence from 30.8 to 5 per cent. of the personnel sustaining accidents. Another estimated that in twelve years it had saved over 23,000 workmen, representing 10 per cent. of its entire personnel, from death or serious injury.

The most interesting sidelight, however, was the statement that only one-third of the reductions had been effected by mechanical safeguards or equipment. In the industries doing the most efficient safety work, two-thirds had been accomplished by organisation and education.

After a reference to the findings of various investigators in the field of accident-prevention in this country and America, Mr. Stephenson described some work which had been carried out by the National Institute of Industrial Psychology, bearing upon the influence of age and experience upon accidents.

The results suggested that ability to acquire the neuro-muscular co-ordination required by a particular process, and to attain the necessary degree of manual skill and dexterity, was at least as important a factor as age or experience. They were in agreement with the findings of other investigators. Psychological tests for eliminating unsafe and incompetent taxi-drivers were tried on 250 men at Pittsburgh over a period of six weeks, and on comparing the test results with the men's filed records it was found that those who had failed in the test averaged more than two accidents to every one encountered by those who had passed the test.

If this proved to be the case, then a further advantage attached to the use of vocational selection tests, for when these were applied to intending entrants into an industry, a large proportion of those who were initially unsuitable for the work could be eliminated instead of being exposed to a greater degree of accident risk than those who were natively adapted to the particular kind of work.

Discussing the effect of artificial illumination upon accident frequency, Mr. Stephenson gave figures to show the difference between the number of accidents recorded from 3.30 to 6 p.m. in the winter and summer quarters. They indicated that there was a tendency for accidents to increase slightly during the hour when artificial illumination was first in use. Then came a period of apparent adaptation, during which the accident frequency decreased, which was succeeded in the last half-hour by an increase of 140 per cent. in the frequency in the winter quarters as compared with the summer quarters.

As to the effects of accidents, and the future lines of approaching the subject of accident prevention, he said that Mr. James J. Davis (U.S.A. Secretary of Labour) had said that the fatal industrial accidents in the United States probably exceeded 23,000 per annum, and non-fatal accidents 2½ millions. The wage loss exceeded a thousand million dollars annually, and it was estimated that they involved a loss of 227,169,970 days' labour. Mr. Davis was advised by experts that 85 per cent. of these accidents were preventable, and he had called a conference to discuss the matter.

In Great Britain there were about 1,200 fatal accidents per annum in factories and workshops, and another 1,200 in coal mines and quarries. Non-fatal accidents of sufficient severity to cause disablement for a week or more numbered 120,000 a year in factories, and 200,000 a year in coal mines. There was evidently still scope for practical humanitarian efforts, said Mr. Stephenson, but too often sympathy was of a static nature, or the employer had so many other managerial functions that industrial insurance was left to look after accident risks. The moral obligation of any employer of labour extended beyond the payment of an insurance premium, and insurance companies could provide a useful incentive to further accident prevention by making equitable rebates in the case of firms which were able to demonstrate reductions in accident risk. A major accident which brought some particular process in an undertaking under the heading of "increased risk" would generally suffice to guarantee an increase in the premium. In a paper on "Safety and Protection in Industry" (Int. Labour Office Studies and Reports, Series F, No. 9), Colonel Pickard mentioned that a working arrangement had been made between the Home Office Workmen's Compensation Committee and the Accident Offices Association, and it was stated that the Association would co-operate in bringing gradually into being a system of discounts from normal rates in consideration of approved safety devices or provisions.

Workers' organisations, suggested Mr. Stephenson, might with advantage sponsor the investigation of individual proneness to accident, particularly in the mining industry, with a view to preventing the entrance of youths into trades in which they would be a menace to themselves and to their co-workers. That this was particularly desirable in the mining industry was evident when it was realised that half the fatal industrial accidents in Great Britain, and more than half the non-fatal accidents, occurred in coal mines and quarries.

Dealing with the economic aspect of accidents, Mr. Stephenson emphasised that quite trivial accidents entailed a heavy loss in production. The further possibility of the transference of emotional effect to other workers in the immediate proximity of the accident, and even to others to whom it was conveyed as an item of news, might result in varying degrees of loss of self-control.

In considering accidents and general efficiency it was unwise to divorce industrial conditions from home circumstances and previous training and environment, and to place the whole onus on industry. In one case investigated, a girl worker who had sustained 7 accidents in 12 months was found to be subjected to ill-treatment at home; consequently, she felt greater freedom at work, and "took chances." In another case a girl sustained 4 accidents in 5 weeks, due to the fear of being discharged.

In conclusion, the author indicated that the problem of accident prevention might be met to a large extent by mechanical safeguards, education and propaganda, the scientific selection of the workers for the job, and the determination of susceptibility to accident. He hoped that researches now being conducted would make it possible to determine this susceptibility. The last two had the advantage of being diagnostic in character, and if the necessary technique could be perfected, and the application of the tests made universal, very far-reaching effects might be anticipated.

The Protection of Aluminium Against Corrosion.

By DR. G. D. BENGOUGH and H. SUTTON.

(Abstract of a paper read before Section G.—Engineering.)

IN this paper the authors pointed out that the resistance of aluminium to corrosion was undoubtedly due to the presence of a protective film of aluminium oxide or hydroxide. It would seem, therefore, that the resistance of aluminium against corrosion might be greatly increased if a thick and strongly adherent film of oxide or hydroxide were formed on the metal. It had been suggested that such a film could be formed by making the metal the anode in a bath of sodium-hydrogen phosphate, but the authors found that the film produced by anodic oxidation in a bath containing chromate, bichromate, or, best of all, chromic acid, protected the metal much more effectively against corrosion. After thoroughly cleaning the metal, it was immersed in a suitable bath, *e.g.*, dilute chromic acid, together with a carbon rod, and a small external e.m.f. was applied to make the aluminium the anode and the carbon the cathode. The applied e.m.f. was gradually raised to a value depending on the nature of the alloy and on the composition of the bath. Thus, with duralumin, in a chromic acid bath, the e.m.f. might safely be raised to 50 V. After treatment for some time in this manner, the surface of the metal became covered with a semi-opaque, uniform, grey coating. The authors stated that the immersed material must consist only of aluminium or suitable aluminium alloys, since other commercial metals were usually attacked by the process and prevented the raising of the voltage; also, the bath should be large compared to the material, otherwise the heat produced by the current would make it difficult to regulate the temperature of the bath. The coating seemed to consist almost entirely of aluminium oxide in a glassy, adherent form. The oxide was possibly hydrated to some extent, but the amount of hydration could not be large since the coating might be heated to at least 350 deg. C. without its changing in appearance or tenacity. Experience had shown that the film would form in any cracks or recesses in the metal provided the liquid could penetrate into them.

After describing the preliminary work, using small baths 2 ft. by 1 ft. 6 in. by 1 ft. 6 in., and a solution containing 3 per cent. chromic acid, chemically pure, a description of a larger plant was given, this being necessary for the treatment of larger areas of metal than had previously been dealt with. In this case the tank was of riveted steel plates of 10 s.w.g., and was 13 ft. long, 2 ft. deep, and 1 ft. 6 in. wide, supported on small steel trestles. At the bottom of the tank an iron pipe was fixed (1 in. internal diameter) traversing the full length of the tank three times, and through this pipe steam could be injected for heating the solution, or cold water for cooling when the bath was being used at full capacity. This pipe was

connected to a steam main under a pressure of 80 lb. per sq. in., but if the temperature of the bath at any time exceeded 40 deg. C., the steam was turned off and cold water turned on. Standard treatment of commercial samples and articles of aluminium and duralumin presented no difficulties. Good samples of aluminium sheet required a current density of 3 to 3.6 A per sq. ft. as a maximum, but the maximum current density was found to vary to a considerable extent according to the articles being treated. It was found that the tensile stress of the material was not influenced by the treatment, but the bending tests showed a marked difference, the limiting radius of the bend in both the longitudinal and transverse directions being much larger in the case of the treated material. On the other hand, duralumin was not affected either as regarded tensile strength or bending. The anodic process provided a protective coating at pores and cracks, but water-line conditions of corrosion broke down even the anodic film. That difficulty, however, had been overcome by dipping the article in molten lanoline or in a solution of lanoline. The net cost of treatment in the experimental bath worked out at 1.93d. per sq. ft., but the principal cost was labour, and under commercial conditions it was anticipated that the figure would be much lower, something like 1d. per sq. ft. for either aluminium or duralumin.

Discussion.

One of the speakers in the ensuing discussion was Professor W. CRAMP (Birmingham), who said that for the most part the electrical processes developed used alkalis, but the authors seemed to have obtained effects with chromic acid, which were less spongy, more complete, and more glassy. Some years ago electrical engineers had used a coating process for aluminium for lightning arresters and other apparatus, which was intended to stand a certain potential gradient, but not a gradient much in excess of that particular value, and the coating in that case was very similar to that obtained by the authors. Though the authors' process might be suitable for aircraft, it might not be satisfactory for electrical purposes, because the coating would break down at an electrical pressure which was much less than the potential gradient of the surface of an overhead wire, particularly a high-pressure one, and it would be interesting to know whether the process could be developed to such an extent as to give protection against the gradient one would expect in electrical plant, and particularly overhead lines. He was disappointed that the authors did not say exactly how long the coating would last. It was stated in the paper that when pitting began under the anodic treatment through breakdown of the glassy coating at one or more points, the current rapidly increased, and the metal was heavily attacked at such points. The oxide produced under those conditions over the pitted area was apparently a non-protective porous variety, instead of the original glassy form. It was very disappointing to find, after going to the trouble of coating a piece of aluminium, that at certain portions where the potential was different, the non-protective porous variety would occur, whilst the rest of the coating was quite satisfactory. He asked whether that could be guarded against.

Mr. SUTTON, replying to Prof. Cramp, said that there would be difficulties in the application of the anodic process to the protection of overhead conductors of relatively high potential. It would seem desirable in that case to put on a coat which would break down at a very much higher potential. Purity of aluminium would be an important consideration there.

British Export Industries.

Before Section F—Economics—on August 11th, Mr. A. W. Flux, C.B., of the Board of Trade, dealt with problems attaching to British export trade, and examined the changes in the oversea markets for the products of our leading exporting industries, more particularly with a view to measuring the changes in the character of the products taken by individual markets or by oversea markets as a whole. For a considerable time before the war, said Mr. Flux, the magnitude of our export trade increased at a rate which afforded ground for satisfaction. Comparing 1913 with 1900, the value of the exports of produce and manufactured articles of the United Kingdom increased by £234,000,000, or just over 80 per cent., an average of 4.7 per cent. per annum, in spite of the sharp set-back of 1908. Then came the check due to the war; the export trade of the United Kingdom now represented approximately 12 per cent. of the value of the world's total exports, as compared with 13 per cent. in 1913, and less than 13½ per cent. in 1900, these percentages relating to value. These figures appeared to suggest that it was the restoration of world trade to its former dimensions and capacity of expansion that could do more to restore our own export trade and the industries that depended upon it, than a struggle to secure for ourselves trade that had been carried on by some other nation, important as it was to maintain our competitive capacity.

Turning from the geographical distribution of our export trade to its industrial distribution, food represented now, said Mr. Flux, a little under 6¼ per cent., as also just before the war, as against a little under 5 per cent. at the beginning of the century. In raw materials coal was the dominant element, responsible for nearly 10 per cent. of our aggregate exports in 1913, but for only 6¼ per cent. in 1925. Other items had increased in importance, but among what were usually termed manufactured exports—which accounted for about 78.8 per cent. of the total in 1913, and for nearly 81 per cent. in 1925, a change due to the lessened importance of the raw-materials class rather than to positive expansion in manufactures—there were four groups which accounted for about one-half of our total exports. In order of monetary importance, those were cotton, iron and steel, wool, and machinery. From representing about 50 per cent. of our exports in 1900, those groups rose to 52.5 per cent. in 1913, and 54.6 per cent. in 1925, and an examination of them seemed to show one of the most promising ways in which to seek light on one of the puzzling problems of our export trade records, *viz.*, the comparatively large increase in average values per unit, viewed in relation to the increase in costs of the relative raw materials. Only two explanations appeared to present themselves; either the cost of the manufacturing processes had increased relatively to the cost of the raw material, or the goods included under important headings in our statistics of trade were different in kind or quality from those similarly included in former periods. It was difficult, however, to arrive at a completely satisfactory explanation. In the case of machinery, the very conception of a standard unit by means of which to measure quantities of the various classes of goods included in the group was far from easy, in comparing the one period with the other. Numbers of machines and weights of machines were alike inappropriate, and the measurement of the average price change was at best a rough approximation. In considering the general position, however, it was not without significance that electrical machinery represented a larger tonnage exported in 1925 by over 23 per cent. than in 1913, and the value per ton was about double that of 1913; the same held good with regard to agricultural machinery and boilers and boiler-house plant, in which cases, however, the tonnage showed decreases. Prime movers other than electrical fell off in tonnage, but it was a striking feature of the 1925 record that 69 per cent. of the tonnage and 66 per cent. of the value was in respect of internal-combustion engines.

In examination of several groups, there had been found a tendency for the relative importance of markets to fall in which the cheaper classes of goods of a given description were sold. If the detail of the various groups of exports bore out the suggestion that the average quality of articles similarly described in our export record had been higher recently than before the war—a suggestion entirely consistent with the known tendency towards the establishment of the simpler forms of certain manufactures in countries in which no manufacture of those kinds, properly so-called, had existed before—then it would follow that the relation of the volume of our exports at present to those of the best pre-war year, 1913, was not one showing a reduction of 25 per cent., or nearly so, as the simple arithmetic suggested, but a reduction of notably less magnitude.

If the comparison of the general increase in wholesale market prices of industrial materials with the substantially greater relative increase in the values per unit of manufactured goods exported meant that our cost of manufacture was too great, it would be a serious symptom. If it meant that the world was ready to pay more highly for the kind of work done in this country than for work done in securing natural products, that might be matter for some satisfaction, but more information was needed to enable us to determine the significance of the figures relating to export trade to-day, as compared with the pre-war figures. The defects of pre-war records, which limited our confidence in comparisons with that period, were now past amendment but, concluded Mr. Flux, it was still possible to render future comparisons with the present deserving of confidence if we took care to improve our records of the trade of our own time.

The Distribution of Pressure in Impulse Steam Turbines.

By W. J. KEARTON, M.Eng.

(*Abstract of a paper read before Section G—Engineering.*)

The nozzle areas in impulse steam turbines are determined in the process of design so as to bring the ratio of blade velocity to steam velocity in each stage as near to that value which ensures maximum efficiency as economic conditions will permit. At partial loads in steam turbines of normal design, and also under the very variable conditions in turbines of the mixed-pressure and heat-extraction types, the nozzle areas are no longer correct and the distribution of pressure and hence of heat drop in the various stages becomes very different from that which exists at the economical load. The paper outlines a method whereby the actual pressure distribution may be calculated. The pressure distribution in a nozzle is largely a function of the cross-sectional area at different points along the nozzle axis, and may be determined readily. In a turbine, however, the velocity of the steam is a continuous function. The method makes use of (*a*) a curve showing the actual total energy available by expansion from the initial to any given pressure, (*b*) a curve showing the approximate specific volume of the steam at any pressure, and (*c*) the equation of continuity. The calculation is by a step-by-step process beginning at the exhaust pressure.

The method is applied first to a high-pressure impulse turbine with nozzle control governing in the first stage. The distribution of pressure, the heat drop, and the ratio of blade speed to steam speed have been calculated for 0.8, 0.3, 0.4, and 0.2 of the full load steam consumption. From the results obtained it is gathered that (1) There is excessive under-expansion in the first stage nozzles. (2) The ratio of blade velocity to steam velocity diminishes in the first stage and increases in the stages near the exhaust end. (3) The initial pressure

in each stage is diminished as the steam rate is reduced. (4) The largest changes in heat drop occur at the low-pressure end of the turbine, there being a slight and fairly uniform reduction in heat drop per stage in those stages more remote from the exhaust outlet. (5) Due to the low exit velocities in the low-pressure stages, the direction of flow of the steam relative to the blades at inlet must be changed considerably with an inevitable increase in the entrance shock losses. In steam turbines governed by simple throttling there is an appreciable reduction of heat drop at light loads. A formula is constructed for this "throttling factor."

The method is next applied to the mixed-pressure turbine. One feature of this type which affects the distribution of heat drop under variable operating conditions is that the nozzles in the low-pressure stages must be large enough to pass the whole of the low-pressure steam, and are thus about twice as large in area as they need be for operation with high-pressure steam alone. The result is that when the turbine is operating on high-pressure steam alone, the heat drops in the last two stages of the machine are appreciably diminished. A further result is that when operating with high-pressure steam alone, the steam pressure in the first low-pressure stage of the turbine, at full load, is only 9.25 lb. per square inch absolute, so that in the event of a small quantity of low-pressure steam being admitted to the turbine, it would be wire-drawn from about 20 lb. absolute to 9.25 lb. per square inch absolute. At partial loads, the amount of wire-drawing and thus the throttling loss would be greater still. It is shown how the probable performance of the machine at partial loads and with varying quantities of h.p. and l.p. steam can be predicted.

Dealing with the heat-extraction type of turbine, the author says that the conditions of operation are very variable, because in addition to the possible variation of power demand, there may be a variation from zero to the full amount of the extraction steam. If any form of nozzle cut-out governing be adopted in the h.p. first stage, the efficiency of the high-pressure stages will be fairly well maintained, as the loss due to throttling will be eliminated. The same remark applies to the admission of steam to the l.p. stages and in extraction turbines constructed by the British Thomson-Houston Company in this country and the Allgemeine Elektrizitäts Gesellschaft in Germany, the pressure-governor controls the opening and closing of a number of "pass-through" valves instead of one. A matter of considerable interest and importance to plant engineers is the position of the "extraction" turbine compared with the heat-extraction steam engine. The latter is usually a two-cylinder tandem engine in which the high-pressure cylinder is of the normal type with admission and exhaust valves and the low-pressure cylinder is of the "Uniflow" type. Here, again, regulation is effected by two governors, *viz.*, a speed governor which, by varying the cut-off in the high-pressure cylinder, controls the supply of steam to the whole engine and also a pressure governor which varies the cut-off in the low-pressure cylinder, so as to maintain a constant pressure in the heating steam main. There is thus no loss due to throttling in the l.p. cylinder either at light loads or with full load and a large amount of extracted steam. In fact, over a certain range, the earlier cut-off leads to an improvement in efficiency. The question of choice is, however, affected by other considerations, such as (1) size (*i.e.*, power) of plant; (2) initial cost; (3) space occupied; (4) cleanliness of heating steam, and (5) steadiness of speed. Except for relatively small powers, most of these considerations weigh in favour of the turbine.

The Direction of Electrons Emitted by the Photo-Electric and Compton Effect.

By Prof. W. WIEN.

(*Abstract of a paper read before Section A—Mathematical and Physical Science.*)

IF Röntgen rays go through a gas, electrons are expelled from the molecules by two entirely different actions. One is the photo-electric emission of electrons which originates the absorption of the Röntgen rays. The other is scattering of the Röntgen rays combined with the emission of electrons and the shift of wavelength. The velocities of the electrons are very different in both cases, the speed of the photo-electric electrons being much greater.

Investigations regarding the direction of the electrons expelled by the photo effect have been made by Loughridge and Auger which showed that most of the electrons are emitted in a direction parallel to the electric vector of the incident Röntgen radiation. Dr. F. Kirchner, chief assistant at the physical laboratory of the München University, has attempted to repeat those observations as much as possible and to extend them to the electrons expelled by the Compton effect. The observations were made with a Wilson chamber and the traces of the electrons were fixed by a stereoscopic camera. The photographic plates could be observed by a stereoscope. The observations could only be made by persons without any knowledge of the direction of the electric vector. The angle δ between the direction of the electric vector and the projection of the trace of the electron on the plane of the photographic plate, which is perpendicular to the polarised Röntgen ray expelling the electrons, has been measured by dividing the right angle into six parts and counting the number of traces in every part. It has been taken into consideration that the Röntgen rays scattered at a right angle are not completely polarised but, by secondary effects, only to 80 per cent.

The curve of the number of photo-electrons depending on the angle δ shows a very high maximum for $\delta=0$ or π. It follows that most of the electrons are expelled in the direction of the electric vector. The curve is much more steep than the sine square curve emphasised by Becquerel. The electric force of the Röntgen rays being by no means large enough to afford such a velocity of the electrons as is observed, an explanation of the observed facts can only be afforded by inner vibrations of the atom. The number of the electrons emitted by the Compton effect has a maximum at right angles to the electric vector. The curve is in good agreement with the curve constant $(1+\sin^2\delta)$. These results can be derived making the assumption that the maximum of scattering takes place at right angles to the electric vector and that the incident ray, the track of the electron and the scattered ray are in the same plane.

Four hundred traces of Compton electrons have been observed. The results were the same in air and in argon. The number of traces of photo-electrons observed was 750. No difference could be detected using carbon-dioxide or argon. The curve of the distribution of the traces of photo-electrons was the same for different wavelengths.

The Asymmetry of the Intensity of the Balmer Lines.

By Prof. W. WIEN.

(*Abstract of a paper read before Section A.*)

IT is well known that strongest lines of the Stark effect show an asymmetrical intensity, which can be reversed if the direction of the electric field or of the canal rays used in the experiment is made opposite. At first it was believed that this asymmetry could only be observed for the lines emitted by the moving atoms of the positive rays.

Herr Wierl, of the München laboratory, has made new observations separating the discharge tube and observation chamber. If canal rays of hydrogen go into nitrogen, one gets only the Balmer lines of moving hydrogen atoms. If one takes nitrogen canal rays going into hydrogen the Balmer lines of hydrogen atoms at rest are obtained only.

The observations showed that the asymmetry of the lines exists in both cases, the one being opposite to the other. This must be explained by the assumption that the asymmetry originates from the direction of the impacts of the atoms in connection with the direction of the electric field, the direction of the impacts being opposite for the moving atoms to that of the atoms at rest. This conclusion could be corroborated by observations in a high vacuum, where the asymmetry disappeared.

If the Stark effect is observed in one electric field at ordinary pressure and then on the same canal ray going through a narrow slit into a second field in a high vacuum, the asymmetry is only observed in the first field. It does not last in the second field though the atoms reach this field within the duration of luminosity.

Broadcast Radio-telephony.

By Capt. P. P. ECKERSLEY, M.I.E.E.

(*Abstract of a lecture by the Chief Engineer of the* BRITISH BROADCASTING CO., LTD.)

Following the now familiar story of the work of a few enthusiasts at the early experimental station at Chelmsford, came the rapid development of broadcasting in America, subsequent to which the British Broadcasting Co., Ltd., was formed on its present basis, and the policy of national broadcasting developed in England, as contrasted with the policy in America, had become the admiration of the world, even including America. The intention from the first had been that private individuals should not make profit out of the undertaking; hence the participation of the Postmaster-General in the control of the Company so far as its financial side was concerned, leaving the Company with a fixed amount of revenue and a fixed maximum dividend. At the moment it did not matter to the Company whether more licences were issued or not, because it had reached its maximum revenue of £500,000 per annum.

Concerning the Government Committee's report on the future constitution of the B.B.C., as a matter of fact a chairman had not yet been appointed. He had been told that in future he would be a Government servant, but reading the report as any member of the public would read it, he could not see that they would necessarily be under Government control; in fact, he should say that the undertaking would be less under Government control than at present, because the idea underlying the future of broadcasting was that there should be no privileges and also no restrictions. In his opinion, only on that idea could broadcasting go ahead. If Mr. Bernard Shaw was to be forbidden to speak because he might be controversial, that would be restricting a new art which was being very carefully watched by those in charge of it. Moreover, in the past, there had been the excuse that the income of the B.B.C. had been restricted, and he hoped that in the future the very simple idea would be adopted by the Government that money subscribed towards a service should go towards that service. The Company could deal with an income many times greater than its present one efficiently in the public interest, and it was difficult to understand why a new and growing thing like broadcasting should be restricted in that manner.

Regarding the technical policy of the B.B.C., Capt. Eckersley said, as he did at Southampton last year, that the aim had been to increase the area of the crystal user (what he then called the "crystal area," a term

he has now abandoned in favour of "service area"). In order to carry out this idea to the full, the obvious thing was to increase the present number of 21 main and relay stations; indeed, to erect 42, but that was not a simple matter. At present, however, the urban areas had been covered in such a manner that 85 per cent. of the users could get an uninterrupted programme, and the next step was to deal with the country areas, work upon which was proceeding.

The Geneva Conference allocation of wave-lengths meant considerable sacrifice on the part of all countries, but he regarded it as extremely satisfactory that such an arrangement should have been come to.

Captain Eckersley visualised a future for wireless in which a combination of wireless and line telephony would enable the whole of the world to be linked, so that public men speaking in any part upon world topics would be heard simultaneously all over the world, which would be a great factor in maintaining world peace. This prospect might be possible in 10 or 15 years, but why stop at linking various parts of one country; why should not countries be linked in the same way? It was there that one of the great possibilities of wireless conjunction with line telephony was to be looked for.

The Classification of Patent Specifications.

By Dr. A. P. Thurston.

(*Abstract of a paper read before Section G—Engineering.*)

In this paper, the author said that patent classification had to achieve various somewhat conflicting objects, *i.e.*, (*a*) to enable a manufacturer or individual to ascertain whether he might manufacture or use an article or process with impunity; (*b*) to enable a manufacturer or individual, in the event of receiving a threat of an action for infringement, to ascertain what his chances were if he fought the action; (*c*) to enable an inquirer to ascertain the whole existing public knowledge of any art or manufacture; (*d*) to enable an inventor or his agent to claim as much as possible under his patent; (*e*) to enable the staff of the Patent Office to protect the public by seeing that no more was claimed than was permissible, *i.e.*, that the claims were novel; (*f*) to enable a manufacturer or individual who found that his competitors had obtained patents to demonstrate the invalidity of such hostile patents or to restrict their scope.

Patent classification should obey the basic laws of classification, *e.g.*, (*a*) it should proceed from wide headings to narrow headings, from terms of great extension and small intension to terms of small extension and great intension; (*b*) it should be adapted to admit interpolations; (*c*) the characteristics chosen for sub-division of any one class or sub-class must be consistent throughout that class or sub-class; (*d*) the headings must be mutually exclusive; (*e*) the terminology used must be consistent, the meaning of terms being invariable throughout.

Patent classification was a classification of subject matter rather than of literary material, and the subject matter was available generally in "penny numbers." Therefore, it was not necessary to follow another law of book classification, namely, to allot a book to the nearest heading of the classification that would wholly contain it. The American schedule obeyed that rule, but the British schedule, in which every sub-division was self-contained, and in which there were no "superior" and "inferior" headings, did not. The system adopted by the British Patent Office was, in the author's opinion, a superb achievement. It had been in daily operation for over twenty years, and had enabled searches to be made with precision and accuracy. In the existing British classification every specification was indexed thoroughly for all matter of interest, whether claimed or not, and appeared in the indices under all relevant sub-headings. This was not the American or German practice. Each class or sub-class was specifically defined by the headings appearing under it, and the references from it to other classes. There were no "see also" references. The published classification and allotment of cases under it was exactly that used by the examining staff. This was not so in the United States Patent Office, where repeat copies were placed in the official search files, that were met only by cross-references in the printed key. This was not so also in German practice. The British classification was based upon construction or structure, and not upon application. Nevertheless, the classification bore marks of its evolution from a classification based upon industries or application.

The Internal-Combustion Engine.

On Saturday, August 7th, Sir Dugald Clerk, K.B.E., F.R.S., gave a popular lecture on "The Rise of the Internal-Combustion Engine." The development of the internal-combustion engine, he said, had occupied no less than three centuries. The earlier inventors had very vague ideas as to the causes of the economy and smooth working of these engines. The old idea was that in a gaseous explosion, pressure and temperature rose with almost infinite rapidity, and after the attainment of maximum temperature, the pressure was supposed to fall almost equally rapidly. It was found, however, that the rise of pressure was very much slower than was supposed and that the maximum pressure attained was less than had been stated. The importance of turbulence in all constant-volume explosion engines was emphasised.

The phenomenon of "knock" was then discussed, and Sir Dugald mentioned that the first engine designed and built by himself, which was quite free from knock, was patented in 1881. The ignition was perfectly smooth in these engines. He had experimented upon four-stroke engines with rich mixtures and had applied super-compression by added air, and also by cooled exhaust gases. The idea was to use strong gas and air charges at high compressions, controlling the flame temperatures, which would then be excessive, by adding cooled exhaust gases under pressure to the cylinder at the charging end of the stroke. At the same time, the mean available pressure was increased, and the proportion of carbonic acid gas in the exhaust prevented pre-ignition and also knocking. He had also applied exhaust gases to prevent pre-ignition in large gas engines when using coke-oven gas, which is rich in hydrogen, and to permit the compression-ratio to be increased without knocking. The exhaust gas successfully dealt with the use of rich gases in large engines, and these had been built in sizes from 300 to 2,000 b.h.p. Small paraffin or kerosene engines of high speed which knocked badly when arranged in the ordinary way became practically silent when their exhaust gases were taken into the engine.

The lecture included a description of many engines, including Diesel types, and showed that in the past 50 years the power of an internal-combustion engine unit had risen from the ½ h.p. of Lenoir to the 15,000 h.p. of large Diesel engines for marine and land work. The thermal efficiency had risen from 15 to 33 per cent., and the total power in use, including petrol engines, in Great Britain and America, was about 100 million h.p.

An Improved Electric Lamp for Miners.

On August 10th, Dr. H. M. Vernon and his collaborator demonstrated an electric lamp for use by miners, which has been evolved with a view to increasing the luminous intensity given by these lamps. Dr. Vernon said that probably there was no single factor in the coal-mining industry which would bring about a better result immediately than a more powerful lamp. The wretched lamp now used was responsible very largely for the fact that miners' nystagmus was costing about a million pounds per annum in compensation, and contributing also to the discontent in the mining industry. There was difficulty in improving the power of the illumination given by the present miner's lamp in the direction of increased voltage, inasmuch as the ordinary lamp already weighed 6 lb., and if the voltage were raised from 2 to 4, it would involve increasing the weight of the lamp to 10 lb. To this the miner objected. Again, if gasfilled lamps were used, the lighting intensity could be doubled, but at present the gas-filled lamp had a very short life. The object of the new lamp which was the subject of the demonstration was to increase the lighting intensity by means of an improved arrangement of reflectors. With the old reflectors little of the light was reflected horizontally, and most of it was scattered. In the new lamp the reflectors above and below the source of light were based on the parabolic form, with the source of light as the focus. It was not desired to reflect the whole of the light horizontally from the lamp, because a moderately divergent beam was necessary, but there was much less scattering than in the old lamps, so that more light was thrown on to the coal face. The top reflector was in the form of an inverted cone, the contour of which was a little flatter than a parabola. Below the source of light there was a collar reflector, having a parabolic contour. The top reflector improved the luminous intensity over that of the ordinary lamp by 31 per cent., and the bottom reflector by 13 per cent., making a total improvement of 44 per cent. The manufacturers of lamp bulbs had intimated that if they received a sufficiently large order they would construct bulbs having a considerably narrower neck than those at present in use. That would enable the collar reflector to be carried higher than it was at present, and would increase the improvement of luminous intensity to 50 per cent. above that of the present lamp.

The Forces Between Ions and a Crystal.

By Dr. J. E. Lennard-Jones.

(*Abstract of a paper read before Section A.*)

The first step towards the correlation of the physical properties of crystals lies in the determination of the forces between the constituent atoms and ions. The size and structure of the crystal cell, for instance, was conditioned by the forces of attraction and repulsion. In certain simple polar crystals of the rock-salt type the forces of attraction may be regarded as known (being electrostatic), and so the forces of repulsion alone require investigation. In some recent researches it has been shown that the forces between certain ions in crystals can be correlated with the forces between the inert gas atoms. The latter have been found by the methods of the kinetic theory, and thus the properties of a crystal have been co-ordinated with those of a gas. Theoretical calculations have been made of the interatomic distances of a large number of crystals which are in satisfactory agreement with the observed values. The coefficients of compressibility and electricity have also been calculated and found to be in fair agreement with the observed values (where these exist). The information about ionic and atomic forces which has been obtained has been applied to other problems of crystal structure as yet unsolved. It has, for instance, thrown considerable light on the reason why certain crystals such as CsCl set as body-centred cubics, while others such as NaCl set as face-centred cubics.

Quantitative Methods in X-ray Crystal Analysis.

By PROF. W. L. BRAGG, F.R.S.

(Abstract of a paper read before Section A.)

In investigations of crystal structure it is assumed that waves in the X-ray region, scattered by the atoms of a crystal, obey the laws of interference which have proved capable of explaining diffraction in optical experiments. This assumption is justified by the success with which crystal structures of a simple type have been analysed. The strength or weakness of diffracted beams can be used in a very general and qualitative way to fix atomic positions with considerable accuracy. Analysis may be made more precise by exact measurements of the ratio between the energy of radiation scattered by a crystal and the energy of the incident beam. Evidence is accumulating that not only are the classical laws of interference obeyed, but also the amount of energy scattered by the electrons is given by the well-known electromagnetic equations. This assumption has now been tested for a large number of crystals. Crystal analysis assumes quite a new aspect when precautions are taken to obtain reliable measurements of intensity of diffraction. The distribution of scattering matter (electron density) throughout the crystal, and surrounding the atoms, can be deduced from the results, and structures of a complex type can be analysed. Though it is possible with rough estimates of intensity to analyse crystals with five or six parameters, and this has been done in several cases, such analyses are tedious and somewhat uncertain. When exact measurements of intensity are available, crystals with a number of parameters expressed in double figures present no great difficulty. We seem to be within measurable distance of achieving the ideal position when the structure of a crystalline body can be deduced as directly from the X-ray data as can the form of a small object from its photomicrograph. In using the classical laws to explain X-ray diffraction we are confronted again by their incompatibility with the quantum laws for the interchange of energy between waves and matter. This does not necessarily invalidate the conclusions as to the distribution of electrons in the atoms drawn from the X-ray data, for in so many other cases the classical laws give the right solution, although there is such strong evidence that their fundamental interpretation requires to be modified.

The Chemistry of Fine Grinding and Fine Powders.

By DR. G. MARTIN.

(Abstract of a paper read before Section B—Chemistry.)

THE subject of fine grinding and fine powders has attracted an increasing amount of research work during the last few years. Fine powders behave in many respects like fluids, and possess many curious properties, especially when colloidal dimensions are approached. The mathematical laws regulating their production have only been ascertained between 1923 and 1925 by researches carried out by the author and his assistants. The powders were produced in an 18-in. by 18-in. experimental tube mill, using quartz sand and 1-in. steel balls. The powders were subsequently elutriated in a stream of air of definite and measured speeds, and the weight, number, and surface of the particles composing them were ascertained. The following laws were found to hold rigorously :—

The surface produced is accurately proportional to the work done. Double the work and the surface produced is doubled, treble the work and the surface produced is trebled.

The number of particles produced increases with decreasing diameter according to the compound interest law.

The average shape of the particles produced in crushing remains the same whether they are large or small.

Crushed sand coming from a grinding mill is composed of homogeneous grades of crushed sand, in which the distribution of the numbers of the particles with their diameters cannot be altered, no matter how often the sand is regraded.

Large Salient-Pole Motors.

The Performance of Crompton Three-phase Synchronous Machines.

IN view of the precautions that have to be taken to ensure the operation of electricity supply systems at a power factor as near unity as possible, the performance of large synchronous polyphase motors demands considerable attention. Hitherto, however, reticence has been exercised in the publication of actual performance records, and the accompanying set of curves will accordingly be found to possess interesting features.

Messrs. Crompton & Co., Ltd., claim to have built the largest auto-synchronous polyphase motors at present installed either in this country or abroad; at the end of 1925 an aggregate of over 41,000 b.h.p. (actual rating) of motors had been applied to industrial service, some of the duties being of an onerous nature, for the starting torque in many cases reaches three times that at full load, and the motors automatically synchronise against more than full-load torque. There are many examples of industrial drives demanding a starting torque of between 25 and 50 per cent. of the normal full-load torque and some machines require a comparatively small starting torque, exclusive of the load due to acceleration.

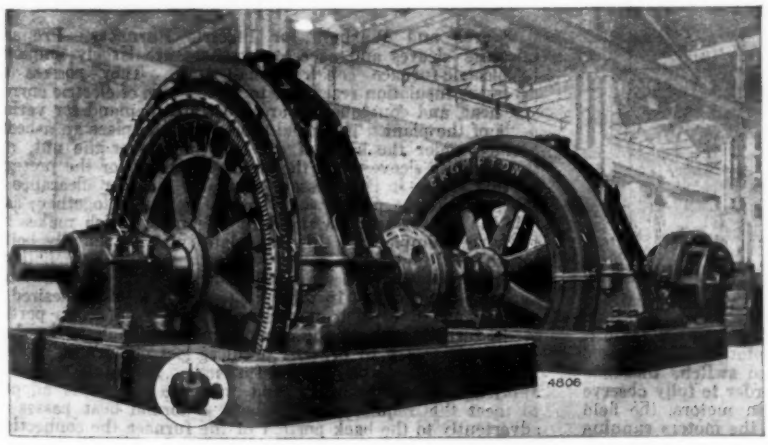


Fig. 1.—Three-phase 2,600-b.h.p. Motors on Test; inset 5-b.h.p. Machine.

A problem which presented itself was the driving of some large wood-pulp grindstones at the Newfoundland Power & Paper Co.'s mills, which have been equipped by Sir W. G. Armstrong, Whitworth & Co., Ltd. Each equipment consists of two grindstones, directly coupled to each end of 2,600-b.h.p. motors. The diameter of each grindstone is approximately 5 ft., and each weighs 9½ tons, the two stones being supported in four white-metal-lined bearings of 13½ in. diameter and 24 in. in length. In view of the starting conditions being comparatively light and the necessity of coupling a grinder at each end of the motor, it was decided to install the self-starting, self-synchronising type of salient-pole, 3-phase machine operating at 2,200 volts, 50 cycles, 231 r.p.m. The motors are supplied from a 30-mile, 6,600-volt transmission line through step-down transformers at the paper mill, and, to compensate for the large inductive drop in the line, the grinder motors were designed to develop their full-load output continuously at a power factor of 0.67 leading (3,100 kVA). The rotors of the motors each weigh 16 tons, with a radius of gyration of 4.2 ft., and are carried in two white-metal-lined bearings of 12 in. diameter and 24 in. in length.

A general view of the two motors on test is shown in fig. 1. One set of the winding guards has been removed to enable details of the stator bar winding and special bracing to be observed. The mechanical construction of the motors is of an exceptionally robust nature, and they have justified the confidence placed in them by operating continuously under the most adverse circumstances and also when *the excitation accidentally failed.*

They operate under exceptionally bad atmospheric conditions; extra leakage distance was provided on the stator windings, and a one-bar winding adopted to facilitate the replacement of any stator bars in the minimum time in case of breakdown. The effective bracing of the winding can be observed from fig. 1, which has prevented any movement, even on emergency acceleration, or when the motors "stalled." The excitation motor-generators supply each synchronous motor at normal full load and 0.67 leading power factor with 310 amperes at 125 volts. To obtain comparatively rapid acceleration with a limited starting current, and without mechanical assistance, the motors were fitted with heavy amortisseur coils of special design; at starting, 50 per cent. of the normal voltage is impressed on the stator by change-over switches, which in practice gives satisfactory acceleration, as will be observed from the diagrams. The auto-transformers were provided with tappings for other voltages when required. The characteristics of these Crompton motors are of unusual

interest. Fig. 2 shows the saturation curve S at no-load for the machines as alternators. Curve E shows the efficiency obtained on actual test, which was 91.25 per cent. at full load. Curve A shows the current consumption during the starting period under normal conditions of working.

The motors are connected to the line at about half voltage by means of a remote electrically-controlled auto-transformer

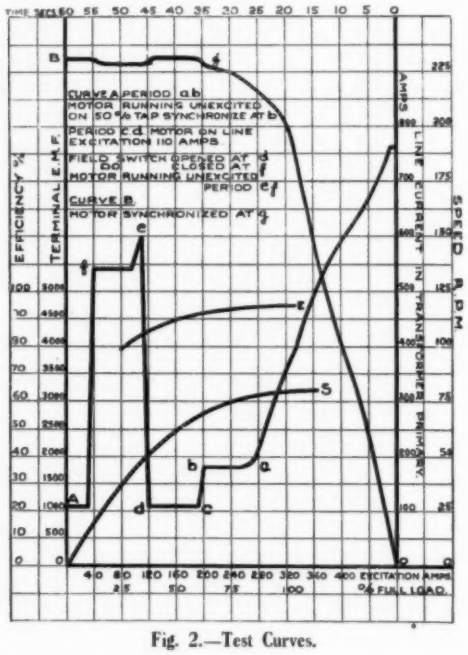

CURVE A PERIOD a b
MOTOR RUNNING UNEXCITED ON 50% TAP SYNCHRONIZE AT b
PERIOD c d MOTOR ON LINE EXCITATION 110 AMPS
FIELD SWITCH OPENED AT d DO CLOSED AT e
MOTOR RUNNING UNEXCITED PERIOD e f
CURVE B
MOTOR SYNCHRONIZED AT g
EFFICIENCY %
TERMINAL E.M.F.
AMPS
LINE CURRENT IN TRANSFORMER PRIMARY
SPEED R.P.M.
EXCITATION AMPS
% FULL LOAD

Fig. 2.—Test Curves.

starter. The load against which the motors have to start comprises, in each case, the frictional resistance of the two bearings of the motor and the four bearings of the grindstones; in addition, there is generally a variable load due to the pressure of the wood logs in the grinder magazines on to the grindstones, which causes a small percentage increase in current. It will be observed that the current in the primary is actually less than the full-load current when switching the

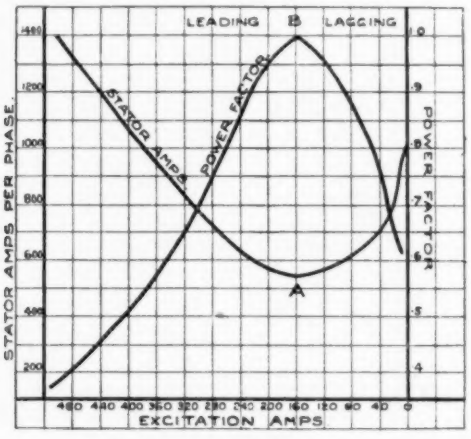


Fig. 3.—Excitation "V" Curves.

motor in circuit, and falls very rapidly until a steady value is reached during the period "*ab*." The motor is synchronised at *b* by means of an electrically-controlled switch, the field being made by hand simultaneously. In order to fully observe the running of the machines as induction motors, the field was again broken at the point "*d*" with the motors running on light load. An instantaneous increase in the stator current to 600 amps. was observed, the current, with the machine running as a synchronous motor, being 107 amps. per phase with 110 amps. excitation. The stator current dropped to 540 amps., at which value the motors ran quite satisfactorily. On again connecting the field in circuit the stator current dropped to its normal value of 107 amps.

The curve B shows the corresponding acceleration during a start, which was made under similar conditions. It will be seen that the acceleration was remarkably rapid, indicating the high torque value obtained from the amortisseur windings. The accelerating was uniform until the motor was synchronised at the point "*g*." In practice it was found possible to run the motors from rest to full speed and synchronise them in 40 seconds with both grindstones directly coupled, including a certain amount of pressure of the wood logs on the stones.

In fig. 3 the "V" excitation curves of the motors indicate the value of the stator current and power factor for different values of excitation current. In fig. 4 is shown the application of the well-known Heyland diagram to the motors. The diagram is of particular interest, as it indicates the operation of the machines when running as synchronous and also as induction motors, and by combining these diagrams the operation of the motors over the whole range of possible output conditions may be studied with advantage. The normal working condition is shown by the vector XL, representing the apparent input of 3,100 kVA; XY is actually the power consumption of 2,070 kW at full load with an excitation current of 310 amps. which results in the motor developing a mechanical output of 2,600 b.h.p. with a power factor of 0.67 leading. By swinging the vector XL round the point L so that the point

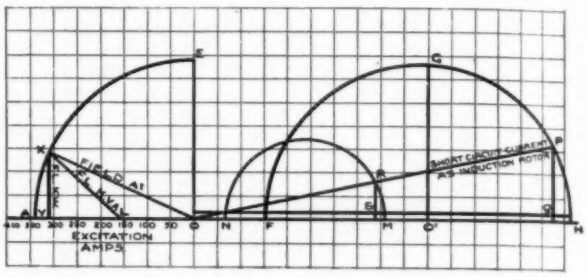


Fig. 4.—Application of Heyland Diagram.

X always lies on the arc AXE, the variation of power factor with the load can be observed, the excitation current being maintained constant. Any ordinates dropped from the different positions of X are proportional to the kW output, the various lengths of XL also showing to scale the kVA input. The ordinates XY, &c., are at the same time proportional to the torque exerted by the motor, this having a maximum value proportional to OE, which, it will be observed, is equivalent to more than twice the full-load torque. At this point the characteristics of the machines pass to the motor curve when operating as induction type, and are shown by the semicircle FGH, where a maximum torque proportional to O G is obtained. As this value is about equal to OE, when operating as a synchronous machine, it is probable that the torque will fall off rapidly until the motor finally stalls at the point P with a stalling torque proportional to PÇ. The characteristics of the synchronous motors when starting at half voltage are indicated by the small semicircle NRM. A perpendicular RS dropped from the point R where the short-circuit current vector cuts the circle is proportional to the starting torque exerted under these conditions.

Over 350 a.c. motors were supplied to this paper mill, including five salient-pole synchronous motors, each of 800 b.h.p. at 600 r.p.m., 2,200 volts, 50 cycles. Also a number of 400-b.h.p. vertical-spindle motors of 730 r.p.m. with squirrel-cage rotors were installed.

Sleeves and Washers for Electric Furnaces.—Prepared micanite sleeves and asbestos washers are largely employed in electric-furnace constructional work. They possess the necessary insulation resistance to the passage of electric current and heat, and consequently are greatly in demand for various parts of the plant. The usual procedure is to place an asbestos washer under the head of the bolt and under the nut, and the micanite sleeve along the stem. To allow for the presence of this sleeve it is necessary to make a larger clearance in the holes in the plates which are to be bolted together; as a rule the sleeves are of a standard thickness, which makes the work very simple. In this way plates may be soundly bolted together without any fear of current passing between them. A thin sheet of asbestos millboard is usually sandwiched between the plates. In other instances it is often desired to pass a current of high amperage through the bottom portion of the furnace without any connection being made to the shell. This is necessary to prevent needless loss of current, besides shock to the operators of the furnace. The same system of applying asbestos washers and micanite sleeves is adopted to meet this requirement. Where abnormal heat passes inadvertently to the back portion of the furnace the connections are apt to be affected, but only in a minor way. The asbestos shows a tendency to crumble, whilst the prepared micanite loses the substance used to bind it; but even under those extreme conditions both materials maintain their property of insulation, the only danger being that they are apt to break and fall away from the bolt. The sleeves and washers are made in sizes to suit standard bolts, and also of different thicknesses. They are usually manufactured by specialist companies, which possess the necessary chemical and mechanical equipment to turn out a product whose properties are to meet such exacting conditions. Although the present price of prepared micanite sleeves is somewhat high, this is not likely to continue in the near future, as new sources of the mineral have lately been exploited. Asbestos washers, which are cheap at present, are not likely to alter materially in price, but a tougher variety which will not crumble after repeated "roastings" will probably be developed.—C.C.D.

Indian Electrical Imports in 1925–26.

THE following are the figures of the electrical imports into India during the twelve months ended March 31st, 1926. In accordance with our usual practice the comparative figures for 1924-25 are also shown and the increase or decrease for each item :—

	1924-25. Rs.	1925-26. Rs.	Inc. or dec. Rs.
Electrical machinery—			
Control and switchgear ...	3,647,000	3,640,000	– 7,000
Generators, alternators and dynamos	3,185,000	4,193,000	+1,008,000
Motors	3,972,000	3,459,000	– 513,000
Transformers	1,322,000	1,849,000	+ 527,000
Turbo-generator sets	407,000	2,760,000	+2,353,000
Other electri al machinery...	7,693,000	6,333,000	–1,360,000
Total	20,226,000	22,234,000	+2,008,000
From United Kingdom ...	17,657,000	18,394,000	+ 737,000
,, Sweden	63,000	93,000	+ 30,000
,, Germany	435,000	936,000	+ 501,000
,, United States	1,519,000	1,973,000	+ 454,000
Electric fans and parts thereof—			
Total	2,553,000	2,825,000	+ 272,000
From United Kingdom ...	1,315,000	1,617,000	+ 302,000
,, Italy	482,000	635,000	+ 153,000
,, United States	178,000	205,000	+ 27,000
Electric wires and cables, rubber insulated—			
Total	2,902,000	3,715,000	+ 813,000
From United Kingdom ...	2,681,000	3,379,000	+ 698,000
,, Germany	139,000	202,000	+ 63,000
,, Netherlands	15,000	55,000	+ 40,000
,, United States	33,000	24,000	– 9,000
Insulations other than rubber —			
Total	1,966,000	2,286,000	+ 320,000
From United Kingdom ...	1,837,000	2,109,000	+ 272,000
Telegraph and telephone wires and cables—			
Total, practically all from United Kingdom	212,000	163,000	– 49,000
Bare copper wire (electrolytic)—			
Total	1,584,000	1,538,000	– 46,000
From United Kingdom ...	1,430,000	1,158,000	– 272,000
All electric wires and cables detailed above—			
Total	6,664,000	7,701,000	+1,037,000
From United Kingdom ...	6,128,000	6,808,000	+ 680,000
,, Germany	274,000	476,000	+ 202,000
,, Netherlands	128,000	192,000	+ 64,000
,, Japan	41,000	85,000	+ 44,000
,, United States	49,000	29,000	– 20,000
Telegraph and telephone instruments and apparatus—			
Total	865,000	770,000	– 95,000
From United Kingdom ...	760,000	702,000	– 58,000
,, United States	66,000	20,000	– 46,000
Electric glow lamps—			
Total	1,232,000	2,001,000	+ 769,000
From United Kingdom ...	407,000	791,000	+ 384,000
,, Germany	163,000	147,000	– 16,000
,, Netherlands	531,000	565,000	+ 34,000
Electric lamps, other sorts—			
Total	275,000	474,000	+ 199,000
From United Kingdom ...	47,000	46,000	– 1,000
,, Germany	46,000	52,000	+ 6,000
,, United States	152,000	349,000	+ 197,000
Batteries—			
Total	729,000	889,000	+ 160,000
From United Kingdom ...	371,000	430,000	+ 59,000
,, United States	203,000	216,000	+ 13,000
Carbons, electric (including furnace electrodes)—			
Total, largely from United Kingdom	89,000	63,000	– 26,000
Accumulators (including parts)—			
Total	1,206,000	1,216,000	+ 10,000
From United Kingdom ...	987,000	902,000	– 85,000
,, United States	176,000	89,000	– 87,000
Electric lighting accessories and fittings (including switches)—			
Total	1,392,000	1,602,000	+ 210,000
From United Kingdom ...	861,000	941,000	+ 80,000
,, Germany	157,000	186,000	+ 29,000
,, United States	333,000	428,000	+ 95,000
Electrical instruments (other sorts)—			
Total	645,000	630,000	– 15,000
Electromedical apparatus—			
Total	106,000	284,000	+ 178,000
Switchboards—			
Total	408,000	321,000	– 87,000
From United Kingdom ...	389,000	305,000	– 84,000
,, United States	10,000	4,000	– 6,000
Unenumerated electrical goods—			
Total	3,219,000	2,966,000	– 253,000
From United Kingdom ...	2,154,000	1,810,000	– 344,000
,, Germany	599,000	489,000	– 110,000
,, Italy	101,000	163,000	+ 62,000
,, Japan	286,000	376,000	+ 90,000
,, United States			
All electrical instruments and apparatus—			
Total	19,716,000	22,500,000	+2,784,000
From United Kingdom ...	14,088,000	15,179,000	+1,091,000
,, Germany	2,261,000	2,220,000	– 41,000
,, Netherlands	713,000	816,000	+ 103,000
,, Italy	529,000	694,000	+ 165,000
,, Japan	183,000	313,000	+ 130,000
,, United States	1,603,000	2,271,000	+ 668,000

Indian Electrical Notes.

(From Our Own Correspondent.)

THE Indian Chamber of Commerce, Calcutta, in a letter to the Bengal Telephone Company, has expressed its opinion that the present scale of telephone charges is too high, and asks for its material reduction. The proposals made are that free calls at the rate of 30 calls per month should be allowed to each subscriber, that the call rate which is now 12 to a rupee should be reduced to 16 to a rupee, with a corresponding reduction in the call rate for subscribers making fewer than 90 calls, and, finally, that an increasing scale of rebates should be introduced in the case of all large users. It is pointed out that Calcutta is in an unfavourable position compared with London in the matter of telephone charges.

All the works connected with the Sukkur Barrage Scheme are now being executed by electric power. A large electric generating station has been erected on the right bank of the Indus with six Diesel engine alternator sets, with the necessary switchboards, oil storage and cooling plant, to provide electrical energy for running the plant to be used on the construction of the barrage and for workshops. The power will be generated at 6,600 V and transformed to 400 V, at which pressure it will be utilised for running land and floating cranes, concrete block yards, mortar mills, air compressors, stone-dressing shops, pumping plant, workshops, &c. The power is carried across the river by a duplicate submarine cable. The overhead distribution in the works area and townships has been practically completed.

The increasing number of electricity supply companies in the Madras Presidency, has necessitated the construction of an up-to-date electrical testing laboratory for the electrical inspector. The estimate, amounting to Rs.60,000, having been sanctioned for the purpose, a new building for the laboratory has been constructed, and the indent has been submitted to the Director-General of Stores, London, for its equipment. It is understood that most of the instruments have been received, but machinery and plant have not yet arrived.

The Tariff Board, in its report on the coal industry, points out that 44 out of the 84 cotton mills in Bombay have now adopted the electric drive. The hydro-electric power now used in Bombay amounts to an equivalent of 450,000 tons of coal. The completion of further generating stations which are now under construction will soon provide sufficient hydro-electric power for all the mills to be driven by electricity.

The individual drive system, which is as yet new in India, has been introduced in the Kaleeswarar mills at Coimbatore, in the Madras Presidency; the necessary plant, &c., was installed by the English Electric Co., Ltd.

The Government of Bombay proposes to grant a licence to Messrs. Killick, Nixon & Co., Bombay, for the supply of electric power and light to Bombay suburbs. The charges proposed are moderate.

The prospectus of the Indian Broadcasting Company has now been filed with the Registrar of Companies, Bombay. The authorised capital is Rs.15 lakhs, divided into 150,000 shares of Rs.10 each, out of which 60,000 shares are now offered for public subscription in India and 2,500 shares are reserved for *bona-fide* importers of radio apparatus. The revenue of the company will be derived as follows:—During the first five years of the company's existence and from the date of commencing a regular broadcasting service from at least one station, 80 per cent. of the revenue from broadcasting receiver licences issued will be paid to the company by the Government. Secondly, 10 per cent. of the import value of all radio receiving apparatus and accessories brought into the country will accrue to the company. It is estimated that the cost of establishing each station, of 12-kW capacity, will be approximately Rs.2 lakhs and that the annual cost of maintaining and operating each station at the outset will be also about 2 lakhs.

Small-Motor Control Equipment.

Some New Designs of Brookhirst Switchgear.

IT has always been a sore point to the installation engineer and others interested in motor control equipment that the same protective features could not be obtained with small apparatus as with large, at any rate, not at a price compatible with that of the driving unit itself, and the engineer's task in explaining away why he recommends the full-control equipment, but not at "that" price, is not an enviable one; the explanation is certainly never satisfactory to the consumer. Attention has been given to this matter by switchgear manufacturers, and it is encouraging to know that Messrs. Brookhirst Switchgear, Ltd., have brought out a new range of switchgear for the smaller types of motors, which they intend shortly to place on the market, and from which we have selected a few models for brief description.

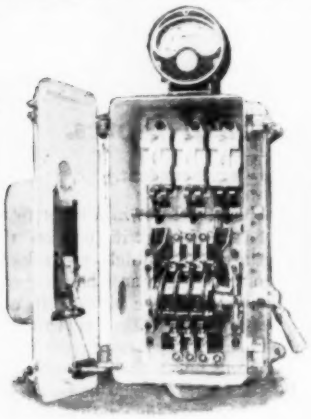


Fig. 1.—Straight-On Starter.

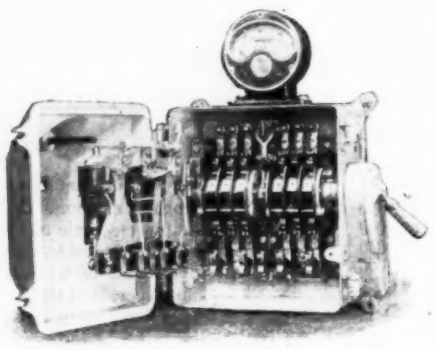


Fig. 2.—Star-Delta Model.

The a.c. equipment, to which special attention has been given, is of the air-break type, the gears being compact and simple, and at the same time including those motor-protective features which are considered desirable. Fig. 1 shows a straight-on starter, A.S.O.10, which consists of a 3-pole rotary quick-make-and-break starting switch, no-volt release and 3-pole double fuses, in combination with a 3-pole fuse-paralleling switch. The gear is operated by a single movement of the handle which closes the starter and parallels the two sections of each fuse. After a reasonable time is allowed for the motor to accelerate, the handle is released, when the fuse-paralleling switch opens, and leaves one section only of each fuse in circuit.

The star-delta starter is standardised either with fuse or overload-trip protection. In the former case the model consists of a double drum comprising a 3-pole quick-break circuit breaker, fitted with a no-volt release, and a 3-pole star-delta starting switch, in addition to the double-fuse feature and paralleling switch. An interesting part of the latter is a swing door accommodating the no-volt and overload coils, giving a maximum accessibility to all parts. This model, ASD.20, with the addition of the overload coils, is shown in fig. 2. It gives excess-current protection in the "run" position only. The operation is similar to that of the last-mentioned type. After a reasonable time for acceleration, with the motor connected in star, the handle is released, when the overload short-circuiting switch opens and introduces the overload trips into the circuit.

The new equipment also includes a number of d.c. models which have been styled as "Midget" appliances. The non-inching "Midget"-type panel comprises a faceplate starter equipped with no-volt and overload releases, two fuses, and a combined d.p. switch and isolator. The variable-speed form includes, in addition, a radial-type shunt-speed regulator. These small models are all equipped with the "safety-first" features of the larger models. For inching duty it has been found necessary to embody an electrically-operated contactor in the control equipment, and a range of control panels, termed "Junior Drum," has been developed. These are equipped with exactly the same protective features as the firm's safety-first drum-type panels. The no-volt feature is provided by the operating coil of the contactor, and protection against excess current is furnished by two overload trips. The isolating switch is similar to that employed in the Midget gears, but serves in this case as an isolator only. The shunt speed regulator, where included, is of the radial type, interlocked against starting with a weak field.

Fig. 3 shows a hand-operated starting panel, JD.20, designed for variable speed (inching) operation. The drum starter is actuated by a ratchet-operating handle, giving a definite step by step movement and "slow motion" starting. The d.p. contactor is equipped with magnetic blowouts, and two solenoid-type overload trips are connected so that an excess current in either pole will trip the d.p. contactor. The isolator is of the usual Brookhirst pattern.

Another very interesting part of the development is a series of small power automatic control gears for d.c. This includes, for motors up to 3 h.p., "Midget" solenoid-type (non-inching) starters and panels, and for motors up to 12 h.p., "Junior" solenoid-type (inching) starters and panels. The starter employed in all these control gears is similar to that embodied in the larger solenoid-type panels. The movement of the starter is such that the wedge-shaped contact bar gives, instead of a sliding movement from contact to contact, a complete and instantaneous contact on each of the several steps in turn. In the "Midget" solenoid starter and starting panel, the action of the starter is controlled by an oil dashpot. While this might seem to be a retrograde step, it will be realised that to adapt automatic control on such small gears necessitates standardisation of equipment at a small price. Considerable effort, therefore, has been devoted to the production of a dashpot designed to ensure a very large measure of reliability. In the design adopted it is almost impossible for the oil to "creep" by virtue of a special "internal jacket" in the dashpot cylinder. Adjustment is arranged by means of a large internal cone giving a wide range of variation and minimising any trouble due to dust, should any find a way inside. In the "Junior" solenoid apparatus the movement of the starter is controlled by means of an eddy current retarder on the same principle as that used in the larger apparatus.

The door-interlocking device is employed, as in other designs, for the isolator. The protective features comprise a d.p. contactor, which, with two overload trips, forms an effective double-pole free-handle circuit breaker. The "Junior" panel is supplied in a constant-speed and two variable-speed forms, both of the latter embodying a hand-operated radial-type shunt-speed regulator interlocked against starting with a weak field. In the one case, the set value of regulating resistance is inserted in a single step, but in the other an automatic accelerator is furnished and the speed accordingly increased gradually.

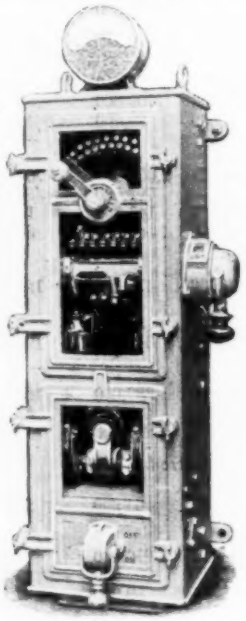


Fig. 3.—Hand-Operated D.C. Panel.

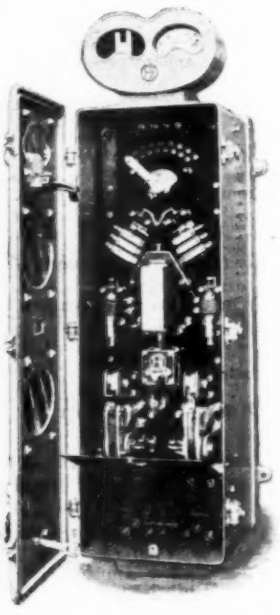


Fig. 4.—Automatic Variable-Speed Panel.

Fig. 4 shows a particularly interesting "Junior" panel of the variable-speed type. It will be seen that the contact unit, the operating solenoid and the retarder are arranged vertically in line, giving a compactness unequalled in the larger equipment.

It is equipped for push-button operation, and the contact element is of the spring-controlled carbon-contact and wedge-contact-bar type, giving complete and instantaneous butt contact on each step under steadily asserted pressure.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

A New Power Unit.

With reference to the article on "Power Supply for Wireless Sets," in our August 20th issue (p. 299), Mr. Arthur W. Reeves writes as follows:—

"I have recently produced a radio power unit which tallies exactly with your contributor's 'summing up' of the requirements necessary to form a satisfactory solution. It supplies 2, 4, or 6 volts *up to* 1.5 *amps.*, and high pressure of from 0 up to 180 volts, 50 *milli-amps.* It works a Burndept 7-valve 'Superhet' with ample reserve, but 2 amps. is quite within its range. It includes infinitely variable voltage regulation for each detector circuit, h.f. circuit, and l.f. circuit, and operates

Fig. 1.—Reeves Power Unit for d.c. Mains.

absolutely silently even when used on mains supplying rectified d.c *via* mercury-arc rectifiers. The latter test is rather exacting, and it is of interest to observe that the d.c. *pulsations* on the south side of Birmingham approximate to a periodicity of 72 cycles per second. (The Birmingham Corporation Electricity Department uses mercury-vapour rectifiers to convert 25-cycle a.c.) The illustrations (figs. 1 and 2; centre adjusting knob was not fitted when the photograph was taken) show the power unit for d.c. mains (any voltage), but the apparatus is also made for a.c. mains of any standard frequency. A voltmeter is fitted on some models with a switch to give readings in every circuit. The whole point is that, irrespective of the

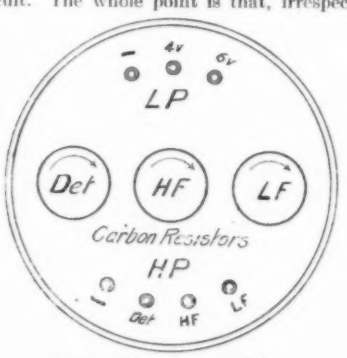


Fig. 2.—Dial of Power Unit.

type of receiver or amplifier used, or the type of valves employed, this power unit can be connected straight away to a lamp socket, or wall plug, and used exactly in the place of the customary accumulators and dry or wet high-pressure batteries. With the exception of a single small pilot/resistance lamp, no valves or bulbs are employed, but an original form of electrolytic condenser is made use of. When used on a lighting circuit at 3½d. per unit, the operating cost with a well-known 5-valve receiver works out to 0.18 pence per hour." The dimensions of the case shown in fig. 1 are 8½ by 7 by 7¼ in. high, and the sole distributors for England are MESSRS. PARKER, WINDER & ACHURCH, LTD.

A New German Valve.

It is reported from Berlin that a number of leading wireless engineers have succeeded in constructing a valve that is claimed to enormously increase the volume of sound received, whilst requiring only the normal amount of current. The characteristic point of the new valve is that in its one glass bulb it contains three distinct valves and all that goes with them. The intensification of sound is said to be produced by the use of a specially dimensioned resistance-intensifier system constructed by Von Ardenne.

A New "NIFE" Battery.

A new type of battery was recently placed on the market by MESSRS. BATTERIES, LTD., for use in the high-voltage circuit of radio-receiving sets. Of the "Nife" type, the new accumulator contains neither lead nor acid, instead of which use is made of steel plates immersed in a steel-preserving alkaline solution. The active material of both positive and negative plates is completely enclosed between finely perforated steel strips, preventing loss of capacity due to shedding of material; the alkaline electrolyte serves only as a conductor, and, as this does not enter into combination with the active materials, the specific gravity remains constant and hydrometer readings are therefore unnecessary. Short lengths of loaded "strip" sealed at each end with special steel caps

Fig. 3.—The "Nife" H.P. Accumulator.

are used for the electrodes in glass tube containers, as illustrated in fig. 3. The electrodes are separated by means of hard rubber. The glass tubes are mounted in holes in a moulded base of "Dagenite" and are finally sealed in position by a layer of insulating compound which is allowed to set over the moulded base; a cracked tube can easily be replaced by cutting away the sealing compound around it. A 10-in. creepage distance is obtained between the electrolyte in any two adjacent cells and loss of current in this way is minimised; as the plates themselves are also free from self discharge, a "Nife" battery will last long on one charge. Each battery consists of 24 tube cells connected in series, giving a total voltage of approximately 30, and as all the inter-cell connections are exposed, it is possible to tap off practically any voltage required, and a wander clip is supplied with each battery. The actual capacity of the HT124 type is 1,000 milliampere-hours, its charging rate 0.15 A for 10 hours, and average pressure 30 volts. The dimensions with the cover removed as shown in fig. 3 are approximately 4¼ by 11 by 6 in. high.

All-Purpose Jacks.

A properly designed jack and plug is so convenient and reliable a means of making, breaking and controlling all kinds of wireless circuits that there is ample reason for its popularity. Various spring and contact combinations can be made to perform a large variety of functions ordinarily associated with keys, switches, and terminals, all of which have to be accommodated on the panel and wired according to requirements. The range of the new model jacks and plug, manufactured by the Ashley Wireless Telephone Company (1925), Ltd., represents simplification. The springs are fitted with pure silver contacts, and are interleaved with genuine bakelite insulation, the various spring groups being rigidly mounted on nickel-plated and polished brass frames, arranged for one-hole mounting on any thickness of panel from ⅛ to ¾ in., and a point which will appeal to set constructors is the fan-like arrangement of the soldering tags which greatly facilitates wiring. The associated plug is interchangeable throughout the full range of jacks, and no screw-driver, or other tool, is required to connect either pin tags or wire ends, which are simply inserted in the holes provided in the moulded cover and are automatically gripped.

South American Colonists' Radio Station.—Marconi apparatus is part of the equipment of British settlers who are leaving this country early in September to open up tracts of country in Bolivia, South America, in accordance with an agreement recently made between the Bolivian Government and Bolivian Concessions, Ltd. They are fitting it up on the vessel in which they are to sail, the 600-ton *President Seevedra*, and will thus enjoy all the advantages of wireless communication throughout the journey. The 500-watt telephone and telegraph transmitter (type YC5) is to be used under normal conditions as a land station; the receiver (type RP4b) mounts five valves, one for reaction, two for high-frequency amplification, one for rectification, and one for low-frequency magnification. Its all-round utility either as a portable, or "semi-portable" model should make it very suitable for the purpose of the settlers.

The Hydro-Electric Power Commission of Ontario.

Eighteenth Annual Report.

We have received from the above Commission a copy of its eighteenth annual report, covering the year ended October 31st, 1925.

This again records substantial progress and a cheapening of supplies. The maximum (20-minute) load recorded in October, 1925, was 808,398 h.p., as compared with 685,938 h.p. in the corresponding month of 1924. The capital invested in the whole system, including electric railways operated by the Commission and municipalities' distributing systems, stood at $276,720,073 on October 31st last. The total revenue from the municipalities and other power customers amounted to $18,002,149. Of this expenses absorbed $13,847,467, and $3,716,844 was put to sinking funds, plant renewal funds, &c., leaving a net surplus of $437,848. The number of municipalities supplied by the Commission's nine systems is about 250. The number of municipalities which incurred deficits on working was very small and the aggregate loss was unimportant. At the same time the profits were not large, it being the aim of the organisation to supply energy at as near cost price as is consistent with financial stability.

The report deals in detail with the operations of the several systems during the year. Some of the principal facts recorded are given below :—

The Niagara System is by far the most important—its maximum load was 683,646 h.p. when the overall maximum was 808,398 h.p. In the same way the Queenston undertaking is the backbone of the Niagara System, the maximum load on the station representing over 500,000 h.p. During the period under review the seventh and eighth generating sets were put into operation, and shortly after the close of the period the ninth commenced work. Each of these sets is rated at 62,000 h.p., and their output was absorbed almost as soon as they started up. The Toronto Power station was shut down for a few weeks to enable holes in the floor of the raceway tunnel to be filled with concrete. The Ontario Power station operated normally. An inspection of one of the 18-ft. steel pipe lines proved it to be in excellent condition and no repairs were necessary. The report mentions, parenthetically, that the illumination of Niagara Falls commenced on May 29th. This is carried out by twenty-four 36-in. diameter searchlights equipped with colour screens, mounted on one of the Commission's buildings. The sub-division of the 100,000-V transmission system into two sections was continued during the year. This work will ensure continuity of supply as it rarely happens that trouble occurs on two sections simultaneously. The Commission's staff continued its thorough inspection of both the high- and low-pressure systems. The plant at some of the sub-stations was increased, notably at the Bridgman and Wiltshire stations, in each of which a 15,000-kVA bank of transformers was installed, raising their capacity to 45,000 kVA.

The Georgian Bay System absorbed the Muskoka System during 1925, and now combines four divisions, which were previously independent systems. This combination has proved beneficial in a number of directions. A shortage of power in the early part of the year was averted by the starting up of the first of two new sets at the South Falls plant of the Muskoka division.

The load on the St. Lawrence System has been affected considerably by the rise and fall in the demands of a pulp and a paper company. A shortage of power was experienced at one period of the year owing to ice troubles at the Cedar Rapids plant; this was partly met by the steam stand-by station of the Brockville Public Utilities Commission. The Rideau System's load decreased considerably owing to the loss of a large power consumer and general industrial quietness. The load on the Thunder Bay System continued to grow satisfactorily and the high load-factor enabled two machines at the Cameron Falls station, which had been rushed into service, to be released for final adjustments. A new station was put into operation in the Central Ontario and Trent System. It is an automatic station of the remote, supervisory-control type and is a duplicate of an earlier station, and, similarly, is controlled from the Ranney Falls plant. Unfortunately, on account of control-cable troubles it has not been safe to operate these stations without someone in continuous attendance. Otherwise the merits of the system have been proved, and it is hoped to overcome the cable difficulty shortly. There was a slight increase in the demand upon the Nipissing System. An old wood-stave pipe line was replaced by a pipe line of larger diameter, increasing the capacity of the plant.

In the Commission's laboratories a great deal of testing work was again carried out, including approval tests of electrical appliances. The largest group of appliances submitted was the heating class; this was followed by wiring devices, portable lamps, motor-operated appliances, current-interrupting devices, and radio apparatus. The Inspection Department also continued its excellent work; only two fatal accidents from electric shock were reported during the year.

The three electric street railway systems operated by the Commission were not extended during the year, but a great deal of reconstruction work was carried out on the tracks, and in some cases single-track lengths were replaced by two sets of rails. The Essex District Railways earned a larger revenue, but the earnings of the Guelph District Railways and the Toronto and York District Railways decreased.

The volume sets out in great detail the accounts of each municipality served, as well as covering the finance of the whole system. The new Acts affecting the undertaking are reproduced, and much data regarding transmission lines is given.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Treatment of Deafness.

Although deafness is a subject that has always been classified under Medicine, there is much in common between this branch of therapeutics and electrical engineering.

At present, those who are unfortunate enough to be deaf have chiefly to rely on certain electrical instruments, of which there is a variety on the market; but it must be admitted that even the best of these are somewhat clumsy and conspicuous, and there is no doubt that they would be discarded as readily as crutches if a purely medical remedy were available.

It is regrettable that but little reliable information is extant with regard to the statistics of deafness, but at a conservative estimate there cannot be fewer than 150,000 deaf people in this country; one may well ask why so little progress has been made in respect of this important subject in comparison with other branches of medical science. The reason is that until recently there was no method of comparing quantitatively the effects of drugs on the sense of hearing, and experimenters had to rely for their results on the statements made by their patients, which for psychological reasons are most inaccurate.

By persevering research an electrical apparatus called an "Audiometer" has now been brought out to measure the smallest change in a person's hearing, without the possibility of error due to psychological influences entering into the result.

This instrument should prove a valuable stimulus to the medical profession. The worker may now study the effect of drug after drug, which may eventually lead to the development of entirely new methods of treating deafness.

I do not wish to dwell too much on the important part that the electrical engineer has played with regard to this invention, nor do I wish to suggest that finality has been reached in the services that the electrical engineer can render to the medical profession; but I do wish to emphasise the need for closer co-operation between the two professions, in order that a united effort may be made to bring relief to those who have the misfortune to be deaf.

C. M. R. Balbi,

Hon. Consulting Electrical Adviser to the National Institute for the Deaf.

Westminster, *August 20th*, 1926.

The Remuneration of the Engineer.

I have read with great interest and much comfort the article by Mr. W. R. Needham on this subject in your issue of August 13th.

It is clear we live in a paradoxical world, where those who perform the more valuable work receive the less monetary reward, and this has always been the case. Wren was paid a "salary" of £150 per annum whilst building St. Paul's Cathedral, and, even allowing for the difference in the value of money, this remuneration is scarcely on a par with the "engineering scale."

Mr. Needham's comparison between the film star and the engineer shows there is something very wrong in the so-called education given to the "masses," in that the amounts they are willing to pay the two classes of men are out of all proportion to the services received in return. For this illogical state of affairs the engineer is partly to blame. How many engineers take a live interest in the work of the County Education Committees, which light-heartedly spend so much of our hard-earned money?

To remedy the injustice referred to above, we must reform the curricula of the primary and secondary schools, and to accomplish this, engineers must either serve on the Education Committees or take steps to put the right men on them.

H. C. Silver.

Ewell, *August 26th*, 1926.

The Remote Control of Broadcast Receivers.

The author of the above article in your last issue does not seem to consider (fig. 5) that the coil B will have a natural wave-length of the order of 400 metres; this, coupled to the fact that if his "remote control" leads are even 5 metres in length the capacity between them must be of the order of 0.00002 mF, will in quite a number of sets quite alter the performance which evidently he has obtained. This, again, makes it impossible to introduce reaction on B without influencing A; also, what about dead-end effect?

For myself I should prefer to see relays fitted, as the circuits proposed seem to introduce too many complexities, especially on the h.f. side.

Also, did he not make a slip in referring to a "series rejector circuit"? Surely he meant "selector." This slip, though easily made, should be avoided if possible; it is nearly as bad as "reactance" for "reaction."

Personally, having no practical experience of remote control, I should have preferred an article on the difficulties encountered. I had better take this opportunity for thanking you for so interesting a periodical.

F. Duffield, A.Rad.A.

Birkenhead, *August 28th*, 1926.

Broadcasting Finance.

At a Council meeting of this Association, held on the 25th inst., the following resolution was passed:—

"That, having regard to the high educational and recreative value of broadcasting and the urgent need of funds for more fully developing the service, the Council of this Association is of the opinion that licence fees should not be subject to any deduction other than the actual cost of collection, and that the amounts already retained by the Post Office in excess of such cost should be paid to the British Broadcasting Company, Ltd."

Clifford & Clifford,
Hon. Secretaries, The Wireless Retailers' Association of Great Britain.

London, *August 27th*, 1926

The Work of James Bowman Lindsay.

I have to thank you for your kindly review of my book on "James Bowman Lindsay," in which I claim that he was the pioneer of wireless telegraphy, as well as of electric lighting, and electric motor power. The study of the development of electricity is not a novelty to me, as I began my investigations on this subject many years ago in Glasgow University under the late Professor Herschell, and have never ceased my interest in the progress of electrical development.

Your reviewer refers to Samuel Breeze Morse as having anticipated Lindsay in the matter of wireless telegraphy. I have carefully considered all that is recorded about Morse, both in American and British biographies of him; but I have failed to find the slightest reference in these to his suggesting "wireless" telegraphy; and I would be glad if your reviewer would give me any reference to this subject specially.

In any case, I am inclined to accept the statement of my friend, Senatore Marconi (and there could be no higher authority) that "the name of James Bowman Lindsay must go down to posterity as that of the first man who thoroughly believed in the possibility and utility of long-distance wireless telegraphy."

A. H. Millar.

Dundee, *August 27th*, 1926.

[Doubtless the phrase "wireless telegraphy" was not invented at the same time as the accomplishment of the feat; but it is recorded in "Samuel F. B. Morse: his Letters and Journals," edited by his son, E. L. Morse, that precisely the same thing that Lindsay did in 1853 was done by Morse in 1842. In the work referred to, Vol. II, p. 185, a letter from Morse to Mr. Vail, dated December 18th, 1842, is printed, from which we take the following passage: "I believe I drew for you a method by which I thought I could pass rivers, *without any wires*, through the water. I tried the experiment across the canal here on Friday afternoon *with perfect success*." In the same volume, on p. 241, is printed a letter which he wrote to "Messrs. Editors," vigorously defending his title to be regarded as the inventor of telegraphy without wires: "The London 'Mechanics' Magazine' for October, 1844, copies an article from the Baltimore 'American' in which my discovery in relation to causing electricity to cross rivers without wires is announced"; the editor of the former magazine had alleged that Morse only rediscovered what was previously well known in this country, and Morse, in his letter, states his claims not only "to be the first inventor of a really practicable telegraph," but also to "the discovery that electricity may be made to cross the water without wire conductors, above, through, or beneath the water," repeating that his method "*dispenses with wires altogether* across the river." The italics are in the originals.

We must correct the date we gave for Morse's first trial of this system (1844) to 1842, antedating Lindsay by over 10 years. —EDS. ELEC. REV.]

An Electric Cigar Sorting Device.—A cigar sorting machine has been perfected for use by cigar manufacturers, which has proved exceptionally accurate and speedy in its work. Cigars are sorted according to the shade of their colouring into no fewer than 30 separate grades, and to do this successfully requires, in a human being, an exceptionally well trained eye. Recently an electrically-operated machine has been developed for this purpose which will do this work with greater speed and accuracy. As this device automatically picks up each cigar and holds it up to its "eye"—a photo-electric cell—the various shades of brown cause varying reactions in the cell, and relays actuated by these different currents select the compartment to which the cigar belongs. The machine grades sixty cigars every minute.—*Jnl. Am. I.E.E.*

Legal.

British Thomson-Houston Litigation.

IN the Vacation Court, on August 25th, Mr. Justice Fraser had before him a motion in the action of the British Thomson-Houston Co., Ltd., against the National Trading & Lighting Co. for an interim injunction restraining the defendants from infringing plaintiffs' patent for gasfilled lamps.

Mr. TOOKEY said that the defendants had consented to treat the motion as the trial of the action, to submit to a perpetual injunction, with an inquiry as to damages, delivery up of the infringing articles, and to pay solicitors' and clients' costs.

His LORDSHIP accordingly entered judgment by consent.

Theft and False Pretences Charges.

WILLIAM WALSH, Wigan, was charged at the local police court on August 26th with damaging the Corporation's electrical fittings, stealing electric lamps, and obtaining money by false pretences. The prosecution stated that the prisoner had stolen lamps from an auctioneer's room and other places, and, representing himself to be an electrical inspector employed by the Corporation, paid visits to premises after thunderstorms on the pretence of examining the electrical installations. In several instances he was alleged to have stated that the replacement of lamps and fuses was necessary, and he made a charge for doing this. Prisoner pleaded guilty, and was sentenced to two months' hard labour in respect of each of the three charges, the sentences to run concurrently.

Theft of Lamps.

AT Leeds, on August 24th, Edwin John Elmes was sent to prison for two months in the second division for the theft of 437 electric lamp globes, valued at £70, belonging to the Tungsram Electric Lamp Works (Great Britain), Ltd., of whose Leeds branch he had been manager. The thefts were discovered by a newly-appointed manager on finding one lamp wrapper in the shop filled with wood wool, and stocktaking then showed that 437 lamps were missing. Prisoner admitted the thefts.

Embezzlement Charge.

AT Leeds, on August 24th, Owen Parker Smith, salesman, formerly employed by the Electrolux Co., Ltd., Leeds, and whose address was given as Richmond, Surrey, admitted embezzling £15 17s. 6d., moneys received for an electric vacuum cleaner sold on behalf of the firm. He admitted also two further embezzlements of £10 and £5 17s. 6d. In defence he said he had had to embezzle in order to live owing to the smallness of his earnings on commission in this time of trade depression. He was prepared to repay the money if given a chance. The Electrolux Co. agreed to this, and the Court reserved judgment for six months.

Alleged Electric Lamp Fraud.

THE *Daily Telegraph* reports that on August 28th, at the Westminster Police Court, John Francis Singleton (*alias* Paul Hermann), a traveller, was charged with fraud and false pretences in respect of the sale of electric lamps. The prosecution stated that prisoner represented himself to be an agent for the firm of Singleton, Hermann & Co., which was non-existent. He called on West-End firms, introducing to them a "wonderful new lamp" guaranteed to last two years and to burn with remarkable brilliance although only consuming half the ordinary amount of energy. His practice was to supply 110-V lamps for 200-V circuits. These, of course, gave a brilliant light while they lasted, but they had a very brief life. A witness for the prosecution said that he had paid £6 for a dozen of these lamps. The first one lasted 20 minutes and none of the others for more than two hours.

Prisoner was remanded, bail being allowed in two sureties of £50.

The German Electrical Industry.

DEALING with the considerable rise in the quotations for electrical securities on the Berlin Stock Exchange in recent months, the *Deutsche Bergwerks Zeitung* states that it was early recognised in the electrical industry that the first condition for the maintenance of competitive ability in the world's markets was to introduce the greatest economy in working. By the reduction of the number of types and the introduction of "flowing methods" of production it has been possible to increase the output and at the same time lower the prices. The idea of the "rationalisation" of production has been taken up abroad; the English Government has drawn up a power economy scheme which is to result in a considerable cheapening of electrical energy and the strengthening of the competitive capacity of English industry. This development, it is said, compels the German electrical industry to consider a systematic combination of the various separate electrical concerns which are often operating against each other.

In this connection the newspaper states that it is an open secret that a German electrical trust will be established within

a measurable period, after the pattern of the steel trust (Ver. Stahlwerke, A.G.). Already before the war relations existed between the A.E.G. and the Siemens-Schuckert group. In recent years, and despite the loosening of the connection between the Siemens group and the Rhein-Elbe Union, the "horizontal" combination of the German electrical industry has been increasingly considered. The guiding motive in this respect was an industrial understanding in Europe and its extension to the United States, with which close relations already existed through the General Electric Company and the Westinghouse Company. It will be in consonance with this international arrangement if the coming electrical trust from the beginning bears a central European character through the inclusion of Swiss and Austrian interests. In this connection the newspaper gives the following table relating to the chief companies :—

Name	Capital in millions of Marks. 1918.	1926.	Last dividend.	Share quotation. Jan. 1926.	Aug. 1926.
Accumulatoren	12	20	8	81	143.75
A.E.G.	155	120	6	82.25	162.6
Bergmann	52	33	6	65	160
Elektr. Lieferg.	30	20	9	66.5	156
Elektr. Licht und Kraft	30	18	8	79	154
Felten u. Guilleaume ...	55	60	6	91.75	149.25
Ges. f. El. Untern. ...	60	40	10	96	183.25
Hamburger Elektrowerke	44	66	10	93.62	150
Lahmeyer	30	18	8	63	137
Pöge	4.5	3.2	0	20	90
Rhein. Elektr.	11	12.5	8	52	138.5
R. W. E.	50	140	8	103.5	164.5
Sachsenwerk	4.25	8.6	6	33	117
Schuckert	70	49	4	50.5	138.5
Siemens u. Halske ...	63	91	6	63.25	196.25

At first sight it is striking that, with one exception, all the companies have distributed dividends, mostly from 6 to 8 per cent., and in two cases 10 per cent. Rates of 6 to 8 per cent. cannot be regarded as low for a bad year such as 1925, when it is considered that most companies, save the A.E.G. and Siemens and Halske, did not pay any higher dividends before the war; in some cases even lower rates were paid. Taken altogether, it can be said that all the undertakings are conducting a very cautious dividend policy and directing their main attention to the strengthening of their internal position by the creation of undisclosed reserves and the increasing of their working funds.

Still more striking has been the upward movement in the quotations for the shares since the beginning of this year. The driving force in this direction has principally been the present remunerativeness of the undertakings and the increased prosperity that is expected from future combinations. Moreover, electric-political matters, and foreign purchases, particularly those of America, Switzerland and Holland, have also played a part.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 25th. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Standard (lettering and design). No. 468,551. All goods in Class 8.—Standard Telephones and Cables, Ltd.

Obeta. No. 470,936. Class 8. Electric batteries.—Oskar Böttcher Gesellschaft, Berlin. (Hans & Danielsson, 321, St. John Street, E.C.1.)

Ionaco. No. 471,622. Class 11. Electromagnetic and therapeutic appliances (not medical) for surgical or curative purposes.—Gaylord Wilshire, Los Angeles, U.S.A. (Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Hercules. No. 469,571. Class 50. Accumulator containers, covers, internal plate supports and similar fittings of bituminous compounds.—Hart Accumulator Co., Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1925.

2,225. "Electron-discharge devices." R. E. H. Carpenter. January 24th, 1925. (Cognate application 23,144/25.) (256,279.)

2,655. "Electromagnetic apparatus specially suitable for electrically reproducing sound records." A. F. Sykes. January 30th, 1925. (Patent of addition not granted.) (256,280.)

3,062. "Electrical cut-outs." B. Bell and W. H. Illingworth. February 3rd, 1925. (256,282.)

8,731. "Telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), A. M. Searle, and J. H. E. Baker. April 1st, 1925. (256,295.)

9,275. "Wireless receiving apparatus." A. H. Midgley. April 7th, 1925. (Cognate applications 17,651/25, 17,936/25, and 27,863/25.) (256,299.)

9,357. "Automatic and semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), and A. J. Chanter. April 8th, 1925. (256,300.)

10,586. "Cooling apparatus for dynamo-electric machines and other electrical apparatus." Deutsche Luftfilter-Bauges. May 10th, 1924. (233,681.)

11,308. "Electrolytic deposits." British Thomson-Houston Co., Ltd. May 2nd, 1924. (233,354.)

11,538. "Electric regulating devices." Igranic Electric Co., Ltd., and J. H. A. Spaink. May 4th, 1925. (256,311.)

11,543. "Starting of electrical converters or the like." B. Thomas and E. Thomas. May 4th, 1925. (256,312.)

11,572. "Receivers for use in connection with wireless telegraphy." Fuller's United Electric Works, Ltd., and A. P. Welch. May 4th, 1925. (256,317.)

11,577. "Automatic and semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), R. A. Moir, and G. C. Hartley. May 4th, 1925. (256,318.)

11,774. "Circuit arrangements for automatic switches used in telephone systems." Siemens Bros & Co., Ltd., and W. G. Patterson. May 6th, 1925. (256,322.)

11,780. "Holders for thermionic valves." Igranic Electric Co., Ltd., and G. F. Dandridge. May 6th, 1925. (256,323.)

11,812. "Cooling apparatus for dynamo-electric machines and other electrical apparatus." Deutsche Luftfilter-Bauges. January 21st, 1925. (246,432.)

11,874. "Variable condensers." R. L. Aspden. May 7th, 1925. (256,324.)

11,939. "Electromagnetic instruments of the movable-iron type." A. J. Martin and E. R. Furderer. May 7th, 1925. (256,328.)

12,009. "Electrical condensers." J. J. Rowe. May 8th, 1925. (Cognate application 15,871/25.) (256,332.)

12,082. "Starting and synchronising of alternating-current dynamo-electric machines." A. Reyrolle & Co., Ltd., and W. A. A. Burgess. May 9th, 1925. (256,335.)

12,940. "Electric transformers." Foster Engineering Co., Ltd., and R. I. Bagnall. May 18th, 1925. (Cognate application 16,214/25.) (256,345.)

13,000. "Impedance bonds for use in railway signalling systems." Automatic Telephone Manufacturing Co., Ltd., A. E. Hudd, and P. N. Roseby. May 19th, 1925. (Addition to 218,826.) (256,347.)

13,891. "Telephone receivers, loud speakers, and like sound-producing apparatus." C. A. Vandervell & Co., Ltd., and H. G. White. May 27th, 1925. (256,355.)

13,956. "Grid-leak attachment for fixed condensers." H. S. Elwood and T. Hough. May 28th, 1925. (256,356.)

14,527. "Electric measuring apparatus." Park Royal Engineering Co., Ltd., and W. R. Matthews. June 4th, 1925. (256,359.)

14,844. "Device for determining the operation of wireless receiving apparatus at a distance from the apparatus." J. R. S. Hawker and A. H. Hayes. June 8th, 1925. (256,363.)

16,962. "Speed control of induction motors." British Thomson-Houston Co., Ltd. July 1st, 1924. (236,565.)

17,455. "Automatic telegraph systems." W. A. Houghtaling and Western Union Telegraph Co. July 7th, 1925. (256,382.)

17,925. "High-frequency apparatus." F. N. Gibbs. July 13th, 1925. (256,386.)

18,340. "Asynchronous phase converters." Siemens-Schuckertwerke Ges. October 27th, 1924. (241,860.)

18,621. "Asynchronous phase converters." Siemens-Schuckertwerke Ges. December 11th, 1924. (Addition to 241,860.) (244,410.)

19,231. "Loud speakers, gramophones, and other sound recording or reproducing apparatus." C. M. de C. de la Bourdonnais, (Prince de Mahe). July 29th, 1925. (256,395.)

20,793. "Electric battery cells." C. Kelway-Bamber. August 12th, 1925. (256,400.)

22,725. "Clips or holders for supporting electric conductors and the like." H. B. Smith. September 11th, 1925. (256,415.)

23,816. "Abutment devices for application to flexible electric conductors for the purpose of resisting a tensile effort between such conductors and elements, such as lampholders, plug and socket connections, ceiling roses, and the like with which they are associated." J. A. Crabtree. September 24th, 1925. (256,419.)

24,602. "Mechanical rectifying of alternating electric currents." Siemens-Schuckertwerke Ges. October 3rd, 1924. (240,857.)

25,278. "Telephonic apparatus." J. Mouilhau. October 9th, 1925. (256,431.)

26,930. "Submarine telegraphy." H. Stahl and H. W. G. Salinger. October 27th, 1924. (241,934.)

28,275. "Loud-speaking telephones." G. T. S. Clarke. November 10th, 1925. (256,443.)

30,373. "Mechanical rectifying installations for high-tension direct current." Siemens-Schuckertwerke Ges. December 2nd, 1924. (244,093.)

31,417. "Refrigerating machine." British Thomson-Houston Co., Ltd. December 16th, 1924. (244,768.)

32,261. "Reduction of losses in transmission systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). December 21st, 1925. (256,458.)

32,515. "Road-illuminating devices for vehicles." G. H. Johnson. December 24th, 1925. (256,460.)

32,613. "Current-generators for lighting vehicles." X. Bullinger. December 24th, 1924. (245,16 .)

1926.

913. "Device for supporting a writing tablet or the like for attachment to a telephone instrument." R. M. Bowen. January 12th, 1926. (256,468.)

1,102. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. January 14th, 1925. (246,150.)

1,428. "Headlights for motor or like vehicles." P. Delaux and Soc. des Phares et Equipements Electriques. January 18th, 1926. (256,473.)

2,405. "X-ray apparatus." C. H. F. Muller (firm of). May 18th, 1925. (252,120.)

2,411. "Operating mechanisms for electric resistance controllers." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). January 27th, 1926. (256,480.)

3,716. "Short wave-length transmitters." C. F. Burgess Laboratories. February 17th, 1925. (247,942.)

3,955. "Electric switches." International General Electric Co., Inc. February 11th, 1925. (247,574.)

4,189. "Suspension devices for electric lamps or other hanging articles." E. Fluerimont. May 9th, 1925. (251,945.)

5,391. "Electron-discharge apparatus." British Thomson-Houston Co., Ltd. March 5th, 1925. (248,739.)

6,900. "Vacuum electric tube devices." Metropolitan-Vickers Electrical Co., Ltd. March 12th, 1925. (249,143.)

8,293. "Electric condensers and methods of manufacturing the same." International General Electric Co., Inc. April 2nd, 1925. (250,226.)

8,774. "Lighting fittings." General Electric Co., Ltd., and E. L. Randall. March 31st, 1926. (256,528.)

8,782. "Device for ventilating telephones and like apparatus." J. A. Van Steyn. April 9th, 1925. (250,571.)

8,801. "Electric arc lamps with parallel carbons." E. Steinberg. June 12th, 1925. (Divided application on 251,129.) (256,529.)

8,874. "Electric transformers." International General Electric Co., Inc. April 2nd, 1925. (250,261.)

9,056. "Electric welding machines and methods of providing an electric current for welding purposes." F. H. Leslie. April 11th, 1925. (250,583.)

9,224. "Electric cigar and pipe lighter with interchangeable glower." H. Agatz. April 7th, 1925. (250,597.)

10,300. "Means for operating electric lighting tubes by means of leaky transformers." Patent-Treuhand-Ges. fur Elektrische Gluhlampen. August 29th, 1925. (256,535.)

10,763. "Electron-discharge devices." Westinghouse Lamp Co. May 16th, 1925. (252,141.)

11,217. "Methods for the electrolytic manufacture of aluminium." H. Dolter. May 4th, 1925. (251,641.)

12,110. "Telephone exchange systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (L. Polinkowsky). March 31st, 1925. (Divided application on 8,589/25.) (256,544.)

12,393. "Electrical control apparatus." R. Maclaren. December 31st, 1925 (Divided application on 254,821.) (256,546.)

14,927. "Electron-emitting cathodes." Westinghouse Electric & Manufacturing Co. July 23rd, 1925. (255,830.)

17,694. "Electrical cut-outs." B. Bell and W. H. Illingworth. February 3rd, 1925 (Divided application on 256,282.) (256,556.)

17,695. "Electrical cut-outs." B. Bell and W. H. Illingworth. February 3rd, 1925. (Divided application on 256,282.) (256,557.)